



NORTH-WEST UNIVERSITY  
YUNIBESITI YA BOKONE-BOPHIRIMA  
NOORDWES-UNIVERSITEIT  
POTCHEFSTROOM CAMPUS

## **A health promotional physical activity programme for adolescents in a semi-urban community: PLAY-study**

Anita Lennox

M.A.



Dissertation submitted for the degree Doctor of Philosophy in Human Movement  
Science at the North-West University

Promoter: Prof. Dr. A.E. Pienaar

Assistant promoter: Prof. Dr. C.J. Wilders

November 2007

Potchefstroom Campus

## FOREWORD

I would like to express my heartfelt gratitude to the following persons:

- ✿ To God for the talent and strength that He gave me to complete this study.
- ✿ Prof. A.E. Pienaar, my supervisor, for her knowledge, insight and time, I appreciate it so much.
- ✿ Prof. C.J. Wilders, my assistant-promotor, for all his time and discernment.
- ✿ Prof. Faan Steyn of the Statistical Consultation Services of the North-West University for his assistance with the statistical analysis of the study.
- ✿ My parents, Piet en Wilna Prinsloo for all their love, support and sacrifice for the last couple of years.
- ✿ My husband Marius for all his love, encouragement and patience.
- ✿ My sincere gratitude to the National Research Foundation (NRF) for the financial support that was provided for the completion of this study.
- ✿ Mr. Brent Record (016 – 9325528) for the translation and language editing of the dissertation.
- ✿ Mrs. Lynette Nel for the final language editing of the dissertation.
- ✿ Mrs. Sandra Brits for the technical assistance.

# ABSTRACT



## **A health promotional physical activity programme for adolescents in a semi-urban community: PLAY-study**

Physical activity (PA) and physical fitness (PF) are regarded as important elements of a healthy lifestyle (Sallis & Patrick, 1994:304; Saxena *et al.*, 2002; Beets & Pitetti, 2004:1796). Literature revealed that adolescents are more inclined to be physically inactive and spent time on sedentary activities, such as watching television (Wang & Biddle, 2001:1; Marshall *et al.*, 2002:413; Neumark-Sztainer *et al.*, 2003:803; Hancox *et al.*, 2004; Malina *et al.*, 2004:479). Adolescents from low socio-economic communities also experience various other barriers, such as performing income-generating activities and family duties (Prista *et al.*, 1997:455; Kriska, 2000:50), time constraints (Saxena *et al.*, 2002), too much homework (Deflandre *et al.*, 2004:31) and distances from sports facilities (Nahas *et al.*, 2003), which prevent them from being physically active. Stunting, defined as height growth retardation, is also a condition that is associated with poor socio-economic status (SES) and various studies showed an occurrence of up to 19% in children (Kruger *et al.*, 2004:566; Cameron *et al.*, 2005:414). Although different intervention studies were conducted to improve stunting, none were based on physical activity intervention (Lunn, 2002:109; Walsh *et al.*, 2002:6).

The first aim of the study was to determine the physical fitness status and physical activity levels of 15-year-old adolescents from a previously disadvantaged community. Secondly, to determine what factors would be regarded as either barriers or motivators for 15-year-old adolescents from this previously disadvantaged community for improving their physical activity and participation in sport and for determining their perception of their own physical activity level. The next aim was to analyse the physical activity choices and aerobic endurance of these 15-year-old adolescents and the effect of a physical activity intervention programme (PAIP) on their physical activity choices and levels and aerobic endurance. The last aim of the study was to examine the effect of a PAIP on the physical fitness of stunted 15-year-old adolescents.

Two high schools (an intervention school [school 1] and a control school [school 2]) in a previously disadvantaged community near Potchefstroom, South Africa, participated in this study. The learners in the control school had a slightly better socio-economic status, determined by income per capita. All Grade 8 learners in School 1 and 2 were requested to participate in the research. Two hundred and fifty-two (N=252) Grade 8 learners (116 boys and 136 girls) in School 1 and N=66 Grade 8 learners (21 boys and 45 girls) in School 2 parents/guardians granted informed consent to participate in the study. The PAIP was conducted for an hour twice a week for 19 weeks directly after school hours for learners from School 1. No physical education classes or organised sport were part of the school curriculum during the intervention. A pre-test/post-test study design was used.

Standard anthropometrical procedures were used to determine body mass, stature and four skin folds. The Fitnessgram (Meredith & Welk, 1999:9) and additional fitness tests were used to determine the physical fitness levels of the participants. The Previous Day Physical Activity Recall (PDPAR) (Trost *et al.*, 1999:342) was used to determine the physical activity levels and television watching hours during one day of the week and weekend respectively. Biological maturity status was determined by means of the 5-stage Tanner scale (Faulkner, 1996:237). The questionnaire of Rowland (1990) which deals with barriers to physical activity and participation in sport was also used. A few of the questions were adjusted and additional questions from Meredith and Welk (1999:50) were added. Demographic information on the SES (income per capita, housing, water and electricity) of the participants, as well as information on how far learners walked to school and how long it took, was also determined.

The data was analysed by means of descriptive statistics, correlational analysis, frequency and rank ordering, t-testing followed by Tuckey post hoc analysis, One-and Two-way Analysis of Covariance (ANCOVA) and Tuckey-Kramer multiple comparisons. The Statistica for Windows and SAS computer programmes were used to analyse the data according to the above-mentioned aims of the study. A p-value smaller or equal to 0.05 was accepted as significant.

The results of the study indicated higher mean physical fitness values in the intervention group compared to the control group. Both boys and girls in the intervention group and boys in the control group were moderately active, while only the girls in the control group showed low levels of physical activity. Longer commuting distances were found in the intervention group, while more hours of television watching were found in the control group. The aerobic fitness,

flexibility and body composition of group 1 and 2 fell within the healthy fitness zone (HFZ), while their strength fell outside the healthy fitness zone, and showed negative relationships with aerobic fitness and flexibility. Television viewing time and commuting distances to school appeared to have a moderate influence on the moderate to low physical activity levels of the total group, and physical activity showed a relationship with higher fitness values.

Regarding the second aim, too much homework, lack of money and family responsibilities were indicated as barriers to being physically active, while encouragement of parents and friends to participate with, were found to be motivational factors. After participation in the physical activity programme it was found that the learners' perceptions had changed and they had better knowledge of the intensity of physical activity.

The results analysed for the third aim of the study indicated disappointing results regarding the effect of the intervention programme and no significant improvement was found, because of poor attendance to the programme. The learners had to be categorised in different attendance groups of the intervention programme. The group with the highest attendance (>70%) of the programme seemed to sustain their aerobic fitness the best. From the activities that were included in the physical activity programme, it was established that netball and soccer had a small effect on the physical activity choices of the group after participating in the programme.

The results of the fourth aim revealed that stunted girls, who participated regularly in the programme, showed better improvement in aerobic fitness and hand grip strength after participating in the activity programme compared to non-stunted girls, while the lean body mass and flexibility on the right side of the body had improved in stunted boys. The stunted boys and girls also showed improvement in different physical fitness variables compared to non-stunted boys and girls.

It can be concluded from the results of this study that participating in an after school physical activity programme is not the answer to improving the physical activity of children living in low SES environments. Such programmes are, however, needed but should be implemented during school hours. The physical activity programme, however, had a positive effect on both the physical fitness (excluding strength) and aerobic fitness as well as on their perception of physical activity and physical fitness of the adolescents, and showed some effect on the fitness of stunted adolescents. Intervention strategies should however be developed to overcome the

barriers that prevented children from low SES communities from being physically active. It is also important to empower these adolescents with knowledge and skills to enable them to maintain and increase their physical activity levels.

Key words: Physical fitness, physical activity, adolescence, socio-economic status, boys and girls, barriers, motivators, stunting

## **‘n Gesondheidsbevorderende fisieke aktiwiteitsprogram vir adolessente in a semi-stedelike gemeenskap: PLAY-studie**

Fisieke aktiwiteit (FA) en fisieke fiksheid (FF) word as belangrike elemente van ‘n gesonde leefwyse beskou (Sallis & Patrick, 1994:304; Saxena *et al.*, 2002; Beets & Pitetti, 2004:1796). Literatuur dui aan dat adolessente meer fisiek onaktief raak en tyd aan sedentêre aktiwiteite, soos televisie kyk, spandeer hoe ouer hulle word (Wang & Biddle, 2001:1; Marshall *et al.*, 2002:413; Neumark-Sztainer *et al.*, 2003:803; Hancox *et al.*, 2004; Malina *et al.*, 2004:479). Adolessente vanuit lae sosio-ekonomiese gemeenskappe ervaar ook verskeie ander hindernisse wat hulle verhinder om fisiek aktief te wees, soos om inkomste gerigte aktiwiteite te verrig, familie verantwoordelikhede na te kom, (Prista *et al.*, 1997:455; Kriska, 2000:50), tydsbeperkings (Saxena *et al.*, 2002), te veel huiswerk (Deflandre *et al.*, 2004:31) en afstande vanaf sportfasiliteite (Nahas *et al.*, 2003). Groeibelemmering word gedefinieer as lengte groeibelemmering en word ook met swak sosio-ekonomiese status (SES) geassosieer. Studies toon ‘n voorkoms van tot 19% in kinders (Kruger *et al.*, 2004:566; Cameron *et al.*, 2005:414). Verskeie intervensiestudies is reeds uitgevoer en gerapporteer om groeibelemmering te verbeter, maar nie een daarvan was op ‘n fisieke aktiwiteitsintervensieprogram gebaseer nie (Lunn, 2002:109; Walsh *et al.*, 2002:6).

Die eerste doel van die studie was om die fisieke aktiwiteitsvlakke en fisieke fiksheidstatus van 15-jarige adolessente vanuit ‘n benadeelde gemeenskap te bepaal. Tweedens, om te bepaal watter faktore word as hindernisse en motiveerders vir 15-jarige adolessente van die benadeelde gemeenskap beskou wat fisieke aktiwiteit en deelname aan sport belemmer/verhinder, asook om hul persepsie van hul eie fisieke aktiwiteitsvlak te bepaal. Die derde doel was om te bepaal wat die fisieke aktiwiteitskeuses van 15-jarige adolessente van ‘n benadeelde gemeenskap is en te analiseer wat die effek van ‘n fisieke aktiwiteitsintervensieprogram op hul fisieke aktiwiteitskeuses en vlakke is, sowel as op hul aërobiese uithouvermoë. Die laaste doel van die studie was om die effek van ‘n fisieke

aktiwiteitsintervensieprogram op die fisieke fiksheid van 15-jarige adolessente wat met groeibelemmering geïdentifiseer is, te ondersoek.

Twee hoërskole ('n intervensie skool, Skool 1 en 'n kontrole skool, Skool 2) vanuit 'n benadeelde gemeenskap naby Potchefstroom het aan die studie deelgeneem. Die leerders van die kontrole groep het 'n effens hoër SES gehad, wat deur per kapita inkomste bepaal is. Al die leerders in Graad 8 in Skool 1 en 2 is gevra om aan die studie deel te neem. Tweehonderd twee en vyftig (N=252) Graad 8 leerders (116 seuns en 136 dogters) in Skool 1 en N=66 Graad 8 leerders (21 seuns en 45 dogters) in Skool 2 se ouers/voogde het ingeligte toestemming gegee om aan die studie deel te neem. Die fisieke aktiwiteitsintervensieprogram is vir 'n uur, twee keer per week direk na skool vir 19 weke vir Skool 1 se leerders aangebied. Geen liggaamlike opvoedingsklasse of georganiseerde sport was tydens die intervensie, deel van die skool kurrikulum.

Standaard antropometriese metings is gebruik om liggaamsmassa, lengte en vier velvoue te bepaal. Die Fitnessgram (Meredith & Welk, 1999:9) en bykomende fiksheidstoetse is gebruik om deelnemers se fisieke fiksheidsvlakke te bepaal. Die *Previous Day Physical Activity Recall* (PDPAR) (Troost *et al.*, 1999:342) is gebruik om deelnemers se fisieke aktiwiteitsvlakke en televisie-ure gedurende een dag van die week en die naweek onderskeidelik te bepaal. Biologiese rypingstatus is deur die 5-vlak Tanner skaal bepaal (Faulkner, 1996). Die vraelys van Rowland (1990) wat sportdeelname en hindernisse vir fisieke aktiwiteit bepaal is ook gebruik. 'n Paar vrae is gewysig en vrae van Meredith en Welk (1999:50) is bygevoeg. Demografiese inligting oor die SES (inkomste, behuising, water en elektrisiteit) van die deelnemers en inligting oor hoe ver leerders skool toe loop en die tyd wat dit neem is ook ingewin.

Beskrywende statistiek, korrelasie-analise, frekwensie en rangorde is gebruik om die data te ontleed. T-toetse opgevolg deur 'n Tuckey post hoc-analise, een-en-tweeringting ko-variensie analise en Tuckey-Kramer veelvuldige vergelykings is voorts gebruik vir verdere analyses wat uitgevoer is. Die Statistica vir Windows en SAS rekenaarprogramme is gebruik om die data volgens die bogenoemde doelstellings te analiseer en 'n p-waarde kleiner of gelyk aan 0.05 is as betekenisvol aanvaar.

Wat die eerste doelstelling van die studie betref, dui die resultate hoër fisieke fiksheidwaardes by die intervensiegroep vergeleke met die kontrole groep aan. Die seuns en dogters van die intervensiegroep en die seuns van die kontrole groep was verder matig aktief, terwyl die dogters van die kontrole groep lae fisieke aktiwiteitsvlakke getoon het. Verder loopafstande is in die intervensiegroep gevind, terwyl meer televisie kyk-ure in die kontrole groep voorgekom het. Albei groepe se aërobiese fiksheid, soepelheid en liggaamsamestelling het binne die gesondheidsfiksheidsone (HFZ) geval, terwyl spierkragwaardes buite die gesondheidsfiksheidsone geval het en 'n negatiewe verband met aërobiese fiksheid en soepelheid getoon het. Televisie kyk-ure en loopafstande na die skool het 'n matige invloed op die matig tot lae fisieke aktiwiteitsvlakke van die totale groep getoon, terwyl fisieke aktiwiteit 'n verband met hoër fiksheidswaardes getoon het.

Die tweede doelstelling toon dat te veel huiswerk, gebrek aan geld en familieverantwoordelikhede as hindernisse beskou word om fisiek aktief te wees, terwyl aanmoediging van ouers en vriende wat ook deelneem as motiverende faktore beskou word. Na deelname aan die fisieke aktiwiteitsprogram is daar gevind dat die leerders se persepsie oor fisieke aktiwiteit en fisieke fiksheid verander het en dat hul beter kennis van die intensiteit van fisieke aktiwiteit getoon het.

Die data wat vir die derde doelstelling geanaliseer is toon teleurstellende resultate in verband met die effek van die intervensieprogram. Geen betekenisvolle verbetering is gevind nie. Weens swak bywoning van die program is bywoningsgroepe gevorm, en die groep met die hoogste bywoning (>70%) van die program het hul aërobiese fiksheid die beste gehandhaaf. Van die aktiwiteite wat ingesluit was in die intervensieprogram, soos netbal en sokker, het 'n klein effek op die fisieke aktiwiteitskeuses van die groep na deelname aan die program gehad.

Die resultate van die vierde doelstelling toon dat dogters met groeibelemmering, wat gereeld aan die program deelgeneem het, die beste verbetering in aërobiese fiksheid en handgreeskrag getoon het na deelname aan die aktiwiteitsprogram in vergelyking met dogters met geen groeibelemmering. Skraal liggaamsmassa en soepelheid na regs het by seuns met groeibelemmering verbetering getoon. Die seuns en dogters met groeibelemmering het ook verbetering in verskillende fisieke fiksheidsveranderlikes in vergelyking met seuns en dogters met geen groeibelemmering getoon.

Uit die resultate van die studie kan die gevolgtrekking gemaak word dat deelname aan 'n fisieke aktiwiteitsprogram na skool-ure nie die antwoord is om die fisieke aktiwiteit van adolessente, woonagtig in lae sosio-ekonomiese omgewings te verbeter nie. Sulke programme moet gedurende skool-ure geïmplimenteer word. Die fisieke aktiwiteitsprogram het 'n positiewe effek op die gesondheidsbevorderende fisieke fiksheid (uitgesluit krag) en persepsies van fisieke aktiwiteit en fisieke fiksheid van die adolessente gehad. Die fisieke aktiwiteitsprogram het ook 'n positiewe effek uitgeoefen op die aërobiese fiksheid van adolessente met groeibemmering. Intervensiestrategieë moet egter ontwikkel word om die hindernisse te oorkom wat adolessente vanuit 'n lae SES omgewing beleef om fisiek aktief te wees. Dit is egter ook belangrik om hul te bemagtig met kennis en vaardighede om hulle in staat te stel om hul fisieke aktiwiteitsvlakke in stand te hou en te verhoog.

Sleutelwoorde: Fisieke fiksheid, fisieke aktiwiteit, adolessente, sosio-ekonomiese status, seuns en dogters, hindernisse, motiveerders, groeibemmering

# INDEX

<b>CHAPTER 1</b>	<b>1</b>
PROBLEM STATEMENT AND AIMS OF THE STUDY	
1.1 Introduction	2
1.2 Problem statement	2
1.3 Aims	6
1.4 Hypotheses	7
1.5 Structure of the dissertation	7
<b>CHAPTER 2</b>	<b>10</b>
A LITERATURE REVIEW OF PHYSICAL ACTIVITY, PHYSICAL FITNESS, EXERCISE GUIDELINES AND PHYSICAL ACTIVITY INTERVENTION STUDIES DURING ADOLESCENCE	
2.1 Introduction	11
2.2 Physical activity, physical fitness and health	12
2.2.1 Physical activity	12
2.2.2 Physical fitness	13
2.2.3 Health	13
2.2.4 The Healthy Fitness Zone (HFZ)	14
2.3 The relationship between physical activity, physical fitness and health	14
2.4 Factors that can influence physical activity and physical fitness	16
2.4.1 Active commuting	17
2.4.2 Gender	17
2.4.3 Age	19

2.4.4	Technology	19
2.4.5	Socio-economic status (SES)	20
2.4.6	Stunting	21
2.5	Health-improving guidelines for exercising	23
2.5.1	Physical activity intervention studies	24
2.6	Perceptions of physical activity, barriers and motivators	26
2.6.1	Perceptions of physical activity	27
2.6.2	Barriers to physical activity and physical fitness	28
2.6.3	Factors that could motivate (encourage) adolescents to be more physically active	30
2.7	Chapter summary	31
2.8	Reference list	33
<b>CHAPTER 3</b>		<b>46</b>
ARTICLE 1:		
PHYSICAL FITNESS AND PHYSICAL ACTIVITY STATUS OF 15-YEAR-OLD ADOLESCENTS IN A SEMI-URBAN COMMUNITY		47
<b>CHAPTER 4</b>		<b>68</b>
ARTICLE 2:		
BARRIERS, MOTIVATORS, SPORT PARTICIPATION AND PERCEPTIONS OF PHYSICAL ACTIVITY AMONG ADOLESCENTS LIVING IN SEMI-URBAN SURROUNDINGS		69

<b>CHAPTER 5</b>	<b>91</b>
ARTICLE 3: THE EFFECT OF A PHYSICAL ACTIVITY PROGRAMME ON THE ACTIVITY PATTERNS, PHYSICAL ACTIVITY LEVELS AND AEROBIC ENDURANCE OF ADOLESCENTS FROM A DISADVANTAGED COMMUNITY: PLAY-STUDY	92
<b>CHAPTER 6</b>	<b>109</b>
ARTICLE 4: THE EFFECT OF A PHYSICAL ACTIVITY PROGRAMME (PLAY) ON THE PHYSICAL FITNESS OF STUNTED ADOLESCENTS FROM A DISADVANTAGED COMMUNITY: PLAY-STUDY	110
<b>CHAPTER 7</b>	<b>133</b>
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	
7.1 Summary	134
7.2 Conclusions	138
7.3 Recommendations	140
<b>APPENDIXES</b>	<b>143</b>
APPENDIX A	
Informed consent documents	144
APPENDIX B	
Physical activity questionnaire	147

## APPENDIX C

Previous Day Physical Activity Recall (PDPAR) questionnaire for the week and Weekend 150

## APPENDIX D

Physical fitness data sheet 153

## APPENDIX E

Maturation questionnaire for boys and girls 155

## APPENDIX F

Submission guidelines for the South African Journal for Research in Sport, Physical Education and Recreation 162

## APPENDIX G

Submission guidelines for the African Journal for Physical, Health Education, Recreation and Dance 168

## APPENDIX H

Submission guidelines for the Journal of Teaching in Physical Education 176

## APPENDIX I

Submission guidelines for Annals of Tropical Paediatrics 178

## APPENDIX J

Submission confirmation form the South African Journal for Research in Sport, Physical Education and Recreation 183

APPENDIX K

Publication confirmation from the African Journal for Physical, Health Education,

Recreation and Dance 185

APPENDIX L

Submission confirmation from the Journal of Teaching in Physical

Education 187

APPENDIX M

Submission confirmation from the Annals of Tropical Paediatrics

189

APPENDIX N

Physical activity intervention programme

191

## LIST OF TABLES

### CHAPTER 3: Article 1

Table 1:	Distances walked to school by learners from both schools	55
Table 2:	Descriptive data and significance of differences between the anthropometrical characteristics of boys and girls in Schools 1 and 2	56
Table 3:	Descriptive data and significance of differences between the physical fitness and physical activity of the boys and girls in Schools 1 and 2	57
Table 4:	The physical fitness of boys and girls from Schools 1 and 2 according to the Fitnessgram's health-benefiting standards (HFZ)	59
Table 5:	Relationships between physical activity and physical fitness	61

### CHAPTER 4: Article 2

Table 1:	Learners' involvement in organised sport or exercise during the last 6 months	76
Table 2:	Learners' perception of their PA status during the last 3 months	78
Table 3:	Participation in activity for at least an hour, sufficient to let you feel out of breath and sweating	79
Table 4:	Rank ordering of factors which emerged as barriers to participating in physical activity	81
Table 5:	Rank ordering of factors which boys and girls from both groups regarded as barriers to participating in physical activity	82
Table 6:	Reasons that would motivate adolescent boys and girls to start exercising or to consider exercising	83

Table 7:	Reasons that will encourage adolescents to be physically active	84
----------	---	----

### **CHAPTER 5: Article 3**

Table 1:	Attendance of the programme, age, gender and biological maturation of the intervention group	96
Table 2:	Mean energy expenditure during the activity sessions over the 6-months intervention programme	97
Table 3:	Activities done by the adolescents in both schools during the week at base line and after the intervention programme	100
Table 4:	Activities done by the adolescents in both schools during the weekend at base line and after the intervention programme	101
Table 5:	Difference between baseline and end testing in energy expenditure of the different attendance groups in the intervention and control groups during the week and weekend	103

### **CHAPTER 6: Article 4**

Table 1:	Characteristics of participants in the different attendance groups (EG 1-3) and the CG: age, gender, biological maturation and percentage stunting of the groups	118
Table 2:	Results of a Two-way ANCOVA for post-pre-test differences of fitness and body composition variables for girls	120
Table 3:	Statistically significant results of a One-way ANCOVA for the post-pre-test differences of girls within attendance groups	121
Table 4:	Tuckey-Kramer multiple comparisons for girls between the non-stunted groups	122
Table 5:	Results of a Two-way ANCOVA for post-pre-test differences of fitness and body composition variables for boys	123
Table 6:	Statistical significant results of a One-way ANCOVA for post-pre-test differences of boys within attendance groups	124
Table 7:	Tuckey-Kramer multiple comparisons for boys between the non-stunted groups	125

## LIST OF FIGURES

### CHAPTER 4

Figure 1: Percentage learners using different types of transport to attend school

75

# CHAPTER 1

## PROBLEM STATEMENT AND AIMS OF THE STUDY



## 1.1 Introduction

Lifestyle choices make adolescents more vulnerable to illnesses, obesity and risk factors, compared to a few years ago. Choices of passive entertainment such as watching television rather than being physically active contribute to the increasingly sedentary problem reported by researchers (Myers *et al.*, 1996:855; Hancox *et al.*, 2004:260).

Physical inactivity is a significant problem in children as well as in adolescents and is associated with risk factors for cardiovascular illnesses, obesity and a general deterioration in health (Shropshire & Carrol, 1998:156; Cooley & MacNaughton, 1999:189; Pate *et al.*, 1999:364; Sharkey, 2002:3; Matton *et al.*, 2006:1114). A number of studies in both Europe and in South Africa, indicate that children's levels of physical activity decrease with age (Freedson & Rowland, 1992:134; Riddoch & Boreham, 1995:87; Engelbrecht 2001:45; Leslie *et al.*, 2001:255; Neumark-Sztainer *et al.*, 2003:803).

Compared to children from higher socio-economic environments, children from lower socio-economic environments do not always have the opportunity to participate in sport and physical activities, since many of them have to spend their free time performing income-generating activities (Prista *et al.*, 1997:455; Kriska, 2000:50). Other barriers inhibiting them from being physically active include a lack of access to sports facilities, domestic responsibilities, lack of information and time (Coetzee, 2003:87). Economic constraints not only contribute to conditions such as stunting and wasting among children living in low socio-economic environments but might also play a role in these children's physical activity behaviour.

## 1.2 Problem statement

Physical fitness (PF) and physical activity (PA) are deemed to be important supportive components for the maintenance of a healthy quality of life and can contribute to the holistic development of the child (Pate *et al.*, 1999:364). Researchers such as Baranowski *et al.* (1992:S237); Shropshire and Carrol (1998:156); Pate *et al.* (1999:364); Baranowski, *et al.*,

(2000); Beets and Pitetti, (2004:1796) and Matton *et al.* (2006:1114) mention in this regard that low physical activity and fitness are associated with various risk factors for cardiovascular illnesses. Regular exercise also appears to improve psychological well-being and the development of a positive self-image, resulting, in general, in better health (Marsh & Johnson, 1994:83; Marshall *et al.*, 1998:910).

Sallis and Patrick (1994:307) and Winnick (2005:406) proposed physical activity guidelines for adolescents which required them to perform activities of a moderate intensity for at least 30 minutes daily. These guidelines also stated that they should perform continuous exercise at a moderate to high intensity level at least three times a week. Meredith and Welk (1999:53) proposed a health-promoting level of activity where children should be active for 45 minutes, three times a week, and adolescents twice a week for 30 minutes. According to these researchers, no distinction should be made between moderate and high intensity activities in order to encourage children to participate in a more active lifestyle. They stated that children and adolescents had to learn that physical activity are important for everyone and that it is not limited to top athletes only. Futhermore, that not only high-intensity activity could provide health-promoting advantages but moderate physical activity as well.

The literature indicated that the physical activity levels of both boys and girls dropped during the teen years and in early adulthood (Riddoch & Boreham, 1995:87; Myers *et al.*, 1996:855; Leslie *et al.*, 2001:255; Neumark-Sztainer *et al.*, 2003:803). Engelbrecht (2001:45) found that, in a mainly lower socio-economic group in the North-West province, 73,3% of girls between the ages of 13 and 15 years were low active and that there was a decrease in their physical activity levels from 13 to 15 years. Regarding gender differences in physical activity levels, a number of researchers showed that boys were more active than girls and boys participated more in activities of 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). Gender also played a role in the choice of activities, where boys preferred team activities (Faucette *et al.*, 1995:S82; Myers *et al.*, 1996:858; Hovell *et al.*, 1999:163) and girls indoor activities and interacting with few friends (Myers *et al.*, 1996:858). It also appeared that the physical activity levels of children tracked into their adult years, meaning that if someone was classified as being low active in childhood, such a person would be similarly classified in their adulthood (Freedson, 1992:280; Pate *et al.*, 1999:373; Matton *et al.*, 2006:1114). Thus, children had to be encouraged to be physically active so that they could

develop the necessary attitudes, values and skills to maintain an active lifestyle in adulthood (Welk & Wood, 2000:30). Monyeki *et al.* (2003:100) found that besides regular exercise, good nutrition was also important for health and optimal functionality. For leisure activities, daily tasks or sport, they indicated that a poor nutritional level was associated with weaker physical fitness where muscle strength, flexibility and balance were important requirements. Thus, good nutrition played an important role in how the body functioned, and the more energy that the body required; the more important optimal nutrition became (Jackson *et al.*, 1999:11).

Besides nutrition there are also other factors which influence physical activity and physical fitness in adolescents. Research indicates that children from lower socio-economic environments and rural areas have higher levels of physical activity compared to children from high socio-economic environments, because they perform quite a number of domestic tasks which result in high energy expenditure and in consequence increases their level of activity (Prista *et al.*, 1997:451; Kriska, 2000:50). However, children in rural communities often do not participate in sport as a result of the lack of access to sports facilities (Coetzee, 2003:87). Besides this it appears that there are other barriers and limitations, such as domestic responsibilities, lack of information, perceptions of little talent or skills and time constraints, which result in these children not being regularly physically active or participating in sport (Coetzee, 2003:87). According to Deflandre *et al.* (2004:31) children from a middle socio-economic environment indicated that they had other things to do with their time and regarded an overload of homework as an obstacle to being physically active. In this regard, the research of Prochaska *et al.* (2003) indicated that a positive attitude towards physical activity contributed to an increased participation in both physical education classes and extra-mural physical activities. Prusak *et al.* (2004:19) investigated the motivational responses of activity choices of Grade 7 and Grade 8 girls and found that if they were given a choice of activities, they were more intrinsically motivated. According to the researchers such self-driven activities required less external control and these children were therefore more motivated to participate in physical activities.

According to Rowland and Freedson (1994:671), physical fitness and physical activity are positively related, although these relationships are found to be lower among children. Positive relationships are indicated between high intensity cardiovascular fitness and the physical activity index: aerobic endurance, flexibility and strength and between muscular strength (lower

limbs) and cardiovascular fitness (Baranowski *et al.*, 1992; Raudsepp & Jürimäe, 1996:264; Jürimäe & Rego, 2002:165; Flouris *et al.*, 2006:200).

Only a few intervention studies which referred to the improvement of physical activity of children were found in the literature (Hall & Fong, 2003:685; Pangrazi *et al.*, 2003:318). In this regard Pangrazi *et al.* (2003:318) presented a lifestyle activity programme for children. Brownson *et al.* (2004:29) presented a walking-based programme in a low socio-economic community. Heesch *et al.* (2003:336) presented a lifestyle intervention programme for adults that taught cognitive and behavioural strategies for incorporating moderate to vigorous physical activities into their daily routines. Limited research studies, regarding the improvement of health enhancing physical fitness components such as aerobic capacity, strength and flexibility, among adolescents were conducted.

Stunting is a condition that is associated with poor SES and is defined as height growth retardation and expressed as a height-for-age z-score (HAZ < -2) (Friedman *et al.*, 2005:915). Wildschutt (2005:77) found that 6,9% of boys and 2,2% of girls aged 14-16 years in the Western Cape were stunted, while Kruger *et al.* (2004:566) indicated that one out of five (19%) 10-15-year-old girls in the North-West Province of South Africa was stunted. Cameron *et al.* (2005:414) indicated a stunted percentage of 19% among 495 two-year-old Soweto, Gauteng, South Africa children, although by the age of five years, only 4% were still stunted. Stunted children were found to be less active (Kruger *et al.*, 2004:567), gained less lean body mass and accumulated more body fat than non-stunted children (Kruger *et al.*, 2004:566; Martins *et al.*, 2004:822).

It is against this background that an investigation was undertaken into the physical activity levels and physical fitness status of adolescents and the influence of a health-promoting physical intervention programme, based on aerobic fitness, strength and flexibility exercises, on children from a lower socio-economic environment in a semi-urban area in the Potchefstroom district in South Africa.

This study is based on the following research questions:

1. What is the physical fitness and physical activity status of 15-year-old adolescent boys and girls from a previously disadvantaged community?

2. What factors will hinder or motivate 15-year-old adolescents from a previously disadvantaged community towards being physically active and what is these adolescents' perception of physical activity?
3. Will a health-promoting PAIP improve the physical activity levels and aerobic endurance of 15-year-old adolescents from a previously disadvantaged community?
4. Will a health-promoting PAIP improve the physical fitness levels of 15-year-old stunted adolescents from a previously disadvantaged community?

Answering these research questions supports one of the basic goals emphasised in the White paper of the Department of Education (No. 3 of 24 July, 1997) for higher education. This concerns the goal to equip people, through the expertise offered by higher education, to use their talents to the best, thus utilising the opportunities for self-realisation which life offers (Department of Education, 1997). Apart from the contribution to science, the research results of this study can be of great value to government bodies, community organisations and kinderkineticists who are involved in the improvement of physical activity behaviour of children in rural and disadvantaged communities. Intervention programmes intended to raise the levels of children's physical activity and fitness can help in the establishment of a healthy lifestyle. Recognising factors which hinder these adolescents from being physically active and factors which motivate and encourage them to be physically active can make a large contribution to raising and improving their physical activity. The condition of stunting can also benefit from the results if it can procure that physical activity contributes to better physical fitness among stunted children.

### **1.3 Aims**

The objectives of this study are as follows:

- 1.3.1 To determine the physical fitness status and physical activity levels of 15-year-old adolescents from a previously disadvantaged community.
- 1.3.2 To determine what factors would be seen as barriers, but also as motivators for 15-year-old adolescents from a previously disadvantaged community to improve their physical activity and participation in sport and to determine the perceptions of their own physical activity level.

- 1.3.3 To determine the physical activity choices of 15-year-old adolescents from a previously disadvantaged community and the effect of a PAIP on their physical activity choices and levels and aerobic endurance.
- 1.3.4 To examine the effect of a PAIP on the physical fitness of stunted 15-year-old adolescents from a previously disadvantaged community.

## **1.4 Hypotheses**

This study is based on the following hypotheses:

- 1.4.1 Fifteen-year-old adolescents in a previously disadvantaged community manifest moderate to high physical activity levels and their physical fitness levels will be in the Healthy Fitness Zone (HFZ).
- 1.4.2 There are several barriers that prevent 15-year-old adolescents from a previously disadvantaged community from having adequate health-promoting physical activity and physical fitness and they have a poor perception of their own physical activity level.
- 1.4.3 The PAIP will improve the physical activity choices, physical activity levels and the aerobic endurance of 15-year-old adolescents from a previously disadvantaged community.
- 1.4.4 The PAIP will improve the physical fitness and the stunting of 15-year old stunted adolescents from a previously disadvantaged community.

## **1.5 Structure of the dissertation**

This dissertation is presented in article format and the structure is as follows:

Chapter 1: The problem statement, aims and hypotheses of the study.

Chapter 2: The literature review regarding physical activity, physical fitness, exercise guidelines and physical activity intervention studies during adolescence.

The reference list of Chapter 1 and 2 follow after Chapter 2 and are finalised according to the requirements set by the North-West University (Harvard Style).

The methods of the research are set out as part of Chapters 3, 4, 5 and 6 which contain the four articles regarding the aims of the study. These articles are

prepared according to the guidelines of the specific journals to which they are submitted. Some changes, such as the tables that were placed in the text and not at the end of the article, were made for technical purposes. The line spacing was also set at one and a half and Arial font was used.

- Chapter 3: Physical fitness and physical activity status of 15-year-old adolescents in a semi-urban community. This article has been submitted to the South African Journal for Research in Sport, Physical Education and Recreation. Guidelines to authors of this journal are presented in Appendix F.
- Chapter 4: Barriers, motivators, sport participation and perceptions of physical activity among adolescents living in semi-urban surroundings. This article has been submitted to the African Journal for Physical Health Education, Recreation and Dance. Guidelines to authors of this journal are presented in Appendix G.
- Chapter 5: The effect of a physical activity programme on the activity patterns, physical activity levels and aerobic endurance of adolescents from a previously disadvantaged community: PLAY-study. This article has been submitted to the Journal of Teaching in Physical Education. Guidelines to authors of this journal are presented in Appendix H.
- Chapter 6: The effect of a physical activity programme (PLAY) on the physical fitness of stunted adolescents from a previously disadvantaged community: PLAY-study. This article has been submitted to the Annals of Tropical Paediatrics. Guidelines to authors of this journal are presented in Appendix I.

1.5.4 Chapter 7 contains the summary, conclusions and recommendations of the study.

1.5.5 Appendixes follow at the end of the dissertation which includes the following.

- APPENDIX A: Informed consent documents
- APPENDIX B: Physical activity questionnaire
- APPENDIX C: Previous Day Physical Activity Recall (PDPAR) questionnaire for the week and weekend
- APPENDIX D: Physical fitness data sheet
- APPENDIX E: Maturation questionnaire for boys and girls
- APPENDIX F: Submission guidelines for the South African Journal for Research in Sport, Physical Education and Recreation
- APPENDIX G: Submission guidelines for the African Journal for Physical, Health Education, Recreation and Dance

- APPENDIX H: Submission guidelines for the Journal of Teaching in Physical Education
- APPENDIX I: Submission guidelines for Annals of Tropical Paediatrics
- APPENDIX J: Submission confirmation from the South African Journal for Research in Sport, Physical Education and Recreation
- APPENDIX K: Publication confirmation from the African Journal for Physical, Health Education, Recreation and Dance
- APPENDIX L: Submission confirmation from the Journal of Teaching in Physical Education
- APPENDIX M: Submission confirmation from the Annals of Tropical Paediatrics
- APPENDIX N: Physical activity intervention programme

Chapter 2 will now follow with the literature review of the study.

# CHAPTER 2

**A literature review of physical activity, physical fitness, exercise guidelines and physical activity intervention studies during adolescence**



## 2.1 Introduction

The purpose of this study was firstly to determine the physical activity and physical fitness status of 15-year-old adolescents who lived in a low socio-economic environment and secondly to establish the factors that would be seen as barriers and motivation to boys and girls living in such environments for improving their physical activity and participation in sport. Thirdly, to determine the physical activity levels and choices during the week and weekend of these 15-year-old adolescent learners and the effect of a PAIP on these physical activity levels and choices. The final aim of this study was to determine the effect of the PAIP on the physical fitness of stunted adolescent children in this low socio-economic environment.

The literature reveals that currently adolescents are more inclined to be physically inactive and spend more time on sedentary activities while they also experience barriers which prevent them from being physically active. These include watching television (Wang & Biddle, 2001:1; Marshall *et al.*, 2002:413; Neumark-Sztainer *et al.*, 2003:803; Hancox *et al.*, 2004; Malina *et al.*, 2004:479), time constraints (Saxena *et al.*, 2002), too much homework, (Deflandre *et al.*, 2004:31) distances from sports facilities and availability of facilities (Nahas *et al.*, 2003).

This decrease in physical activity and physical fitness in adolescents (Riddoch & Boreham, 1995:87; Kemper *et al.*, 2001:400; Leslie *et al.*, 2001:255; Neumark-Sztainer *et al.*, 2003:803; Beets & Pitetti, 2004:1796) is a matter of concern since physical activity and physical fitness can be regarded as important elements of a healthy lifestyle (Sallis & Patrick, 1994:304; Saxena *et al.*, 2002; Beets & Pitetti, 2004:1796). Low physical activity and fitness make them vulnerable to health risk factors such as obesity, high cholesterol, high blood pressure and the development of coronary heart disease (Chan *et al.*, 2003:787; Mavridis *et al.*, 2004:338; Matton *et al.*, 2006:1114). It is thus important to review the literature regarding physical activity (PA) and physical fitness (PF), in order to find reasons why the physical activity levels of children, specifically adolescents, are decreasing, and more especially in children growing up in disadvantaged communities. Another factor that can possibly influence PA and PF of adolescents living in low socio-economic environments is stunting (height growth retardation). Stunting affects more children from low socio-economic environments and also more boys than girls (Friedman *et al.*, 2005:917; Wildschutt, 2005:77). Very little is, however, known about the effect of stunting on PA and PF.

Thus physical activity and physical fitness of adolescents, especially from disadvantaged communities, and stunting will be investigated in more depth and discussed in this literature review in an attempt to cast more light upon these aspects. Furthermore, barriers and motivators that can influence PA and PF will be discussed in order to obtain a better understanding of the decline in PA levels among adolescents. Exercise guidelines for children and adolescents as well as the results of intervention studies, based on PA intervention will also be discussed. A short discussion of the terminology used in this study will now follow.

## **2.2 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 as well as the healthy fitness zone which has direct relevance to this study will firstly be defined whereafter a discussion of the relationship between them will follow.

### **2.2.1 Physical activity**

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). 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.

## **2.2.2 Physical fitness**

Physical fitness (PF) is described by 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).

## **2.2.3 Health**

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). Good health, according to 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.

#### **2.2.4 The Healthy Fitness Zone (HFZ)**

There are minimum standards for physical fitness, described by 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).

### **2.3 The relationship between physical activity, physical fitness and health**

The following section will shed more light on the relationship between PA, PF and health among adolescents.

The advantages and health promotional effect of PA is well documented in research. 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). A study in this regard done by 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).

Researchers (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<sub>2</sub> 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). In their study, 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. To confirm

these research findings Marsh and Johnson (1994:88) also did not find a significant relationship between PA and flexibility. However, Jürimäe 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.

## **2.4 Factors that can influence physical activity and physical fitness**

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. According to researchers (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.

### **2.4.1 Active commuting**

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. In contrast to active commuting to school more and more children were, for various reasons being transported to school (Tudor-Locke *et al.*, 2001:310; Biddle *et al.*, 2003:32; Fox *et al.*, 2004:345; Hamlin & Ross, 2005:32).

Thus the conclusion can be made that active commuting could contribute to setting a healthy lifestyle in children and adolescents.

### **2.4.2 Gender**

Various researchers have shown that boys are more active than girls and that 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. In the study of 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. The study of 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.

### 2.4.3 Age

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.

### 2.4.4 Technology

According to the research of Biddle *et al.* (2003:32), adolescents spent 2,25 hours per day watching TV, 40 minutes on video games and 30 minutes using computers. The influence of watching television on various health factors was investigated by 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.

In contrast to the above research findings, Marshall *et al.* (2002:413) and 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. This tendency is also confirmed by the research of 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 has 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.

#### **2.4.5 Socio-economic status (SES)**

In a study by 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. In the study of 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.

Regarding gender differences and SES, 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.

#### **2.4.6 Stunting**

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). Stunting is defined as height growth retardation and is expressed as a height-for-age z-score ( $HAZ < -2$ ) (Friedman *et al.*, 2005:915). It was indicated by the research of 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. The same tendency, where stunted girls stored relatively more body fat than non-stunted girls was confirmed by the study of 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.

Intervention studies were conducted by researchers in an effort to improve children's stunting. 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 affect 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.

The following section of this literature study will focus on exercise guidelines and the results of intervention studies based on physical activity.

## **2.5 Health-improving guidelines for exercising**

Besides preventing illness, PA also contributes to the quality of life, psychological health, the ability to meet the physical requirements in the work situation and participation in recreational activities (Sallis & Patrick, 1994:304). In order to benefit from PA the ACSM and the Centers for Disease Control and Prevention (CDCP) have suggested that adults should be moderately active for 30 minutes for most days of the week or even every day of the week (Jackson *et al.*, 1999:32; ACSM, 2000:137; Sharkey, 2002:7; Hamlin & Ross, 2005:31). Various activities such as walking, gardening, dancing, cycling, running or swimming can contribute to this total of 30 minutes. Regular participation in moderate-intensity PA is associated with health benefits even when aerobic fitness remains unchanged (ACSM, 2000:137). Another guideline for exercise sessions pertains to the format and this states that it should include a warm-up phase (10 minutes), an endurance phase (20-60 minutes) and a cool-down phase (5-10 minutes) (ACSM, 2000:140).

The International Consensus Conference on Physical Activity Guidelines for Adolescents was held in San Diego in 1993. According to Sallis and Patrick (1994:306) two guidelines for adolescents were established by this organisation. The first guideline stated that all adolescents should be physically active daily, as part of sport, games, work, transport, recreation, physical education or organised exercise in the context of family, school or community activity. The second guideline stated that adolescents should participate in

activities of approximately 20 minutes' duration at an intensity level between moderate and high for three or more sessions per week. Physiological benefits of exercise could also be obtained by doing aerobic exercises for 20 minutes' duration, three times per week and at an intensity of 70% of the maximum heart rate. A significant effect could be obtained after 10–15 weeks, according to Sallis and Patrick (1994:306). A health benefit could be obtained by exercising for a minimum of 30 minutes duration, three times a week at an intensity of 75% of the heart rate reserve (Sallis & Patrick, 1994:305). Children and adolescence were encouraged to be active on all or most of the days of the week for at least 30 to 60 minutes. Adolescents could lower their frequency and duration of exercise for higher levels of intensity (moderate to high) (Winnick, 2005:406).

### **2.5.1 Physical activity intervention studies**

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). In a study of Grade 9–11 adolescents from a low socio-economic environment, 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). In the Western Cape, a province in South Africa, 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.

## **2.6 Perceptions of physical activity, barriers and motivators**

The following section will discuss literature on the perceptions that adolescents have on PA as well as motivators and barriers to PA and PF that adolescents experience.

## 2.6.1 Perceptions of physical activity

Children's and adolescents' perceptions of PA and PF can be inaccurate and can therefore influence participation in PA. In the study of Placek *et al.* (2001:316) they asked urban Grade 6 children to describe what they regarded as PF, as well as other relevant questions. The children compared fitness to appearance, indicating a thin person as a fit person (Placek *et al.*, 2001:316). About 87% of the children compared the effect of an exercise programme with weight loss and weight control. They did not have knowledge about the different types of fitness (endurance, flexibility, strength, and muscle endurance) and appropriate exercises for each type of fitness. Eighty seven percent of the children indicated that they did not know the meaning of aerobic endurance. Regarding the frequency, duration and intensity of the exercise, 87,2% could indicate that there should be a minimum of three days of the week on which aerobic exercises, such as running or walking, should be done (Placek *et al.*, 2001:316). Aerobic exercise should be done for at least 20 minutes, according to 97,2% of the children, but they had no knowledge of the intensity of the exercise (Placek *et al.*, 2001:316). According to adolescents in New Zealand, perceived benefits of PA are centered on five major themes: fun, achievement, physical, psychological and preferential activity factors (Hohepa *et al.*, 2006:330). Paxton *et al.* (2004:110) found that there was a relationship between adolescents' perceived physical skills (individual's perception of his/her skills to perform a specific activity), attraction to physical activity and physical activity behaviour. This positive correlation indicates that as the adolescent's perception of skill and attraction to PA increases, so will the physical activity in which they participate increase (Flohr & Williams, 1997; Paxton *et al.*, 2004:109). Van Deventer (1998/99:89), in his study, found that boys and girls (black, white and coloured) between the ages of 13 to 21 regarded non-active participation in recreation as being more important than school sport and physical recreation activities. Adolescent girls, who believed in the importance of exercise, were sufficiently physically active and were more inclined to become involved in physical education classes or a sports team (Saxena *et al.*, 2002).

The conclusion can be made that knowledge of PA and PF is thus important for adolescents to improve their understanding of PA and PF and to help increase PA and PF, by motivating them to participate on a more regular level.

## 2.6.2 Barriers to physical activity and physical fitness

According to Jackson *et al.* (1999:321) barriers to the participation in PA fell into four categories, namely: personal (demographic and cognitive), environmental, social and the history of exercise. Biddle and Mutrie (2002:37) reported that there were five types of barriers that prevented adults from doing more exercise, namely: physical, emotional, motivational, time and availability. Lack of time and accessibility to facilities were the two main reasons for not being physically active (Jackson *et al.*, 2004:321). Deflandre *et al.* (2004:31) found that children from an average socio-economic environment regarded the overload of homework and other things to do as barriers to being physically active. Sallis *et al.* (1996:131) also investigated barriers in adolescents from low and high socio-economic environments in San Diego, California, and found that those from a low socio-economic group regarded lack of sufficient facilities and community safety as barriers. American adolescents from low socio-economic environments identified time spent doing homework (86,6%) and looking after babies (56,1%) as hindrances to being PA. Although only 63,1% of adolescents participated in after-school activity programmes, an association was made between higher frequency of high intensity PA and higher economic status, safe areas for facilities, more supervising adults at facilities, higher quality of locations and more hours spent in after-school programmes (Romero, 2005:256). Other barriers (for these adolescents) were the poorer quality of facilities and not being able to afford the fees for the facilities. Lack of time, distance from facilities and the cost of supervised programmes were identified as further barriers by 15-24-year-old males and females (Nahas *et al.*, 2003). The researchers found that Americans regarded lack of time as the biggest barrier, although they spent more than half their leisure time in front of the television (Nahas *et al.*, 2003). Sayed *et al.* (2004:306) did a study of 18-40-year-old men and women in three communities in Botswana to investigate barriers to participation in sport and recreation. Socio-economic factors and facilities were given as the main reasons for lack of participation (Sayed *et al.*, 2004:310).

According to Marshall *et al.* (2002:406) in their study of 11–15-year-old boys in the United States of America (USA) and United Kingdom (UK), most of leisure time was spent on television (TV) games and watching TV. Allison *et al.* (2005:162) found that 15-16-year-old boys regarded the following as internal barriers: physical limitations (for example, too young, too old, overweight), psychological limitations (for example, too lazy, lack of self-confidence,

boredom), parents who attached higher value to academic achievement than PA, and a preference for technological activities (watching TV, computer games, Internet). External barriers were: friends and family influencing their decision to be PA, parents limiting their time and not allowing them to play outside, lack of time (other responsibilities), PA programmes/activities not easily accessible and too expensive (Allison *et al.*, 2005:163). Other things pertaining to their time, such as lack of time to exercise and tiredness were identified as bigger barriers by boys, according to Tergerson and King (2002:376).

Time was the biggest barrier for young men and women in New Zealand, although women also experienced more emotional hindrances than men (Hamlin & Ross, 2005:34). Saxena *et al.* (2002:283) also found that 56% of adolescent girls did not participate in PA, because there was not enough time. In this study there were 44% who were too lazy to be physically active, 15% did not have a place to exercise, 10% stated that it was too boring, 6% said it was too painful, 7% did not know how to exercise and 5% did not like sweating. Girls, according to Sallis *et al.* (1996:131) and Romero (2005:257), experienced more barriers than boys. Lack of affordable and accessible recreational facilities, traffic safety and low parental motivation were, to 7–8-year-old black American girls, the greatest barriers, as well as the fact that they watched too much television (Gordon-Larsen *et al.*, 2004:221). Not enough time to exercise, having other things to do and tiredness were barriers which girls experienced, according to Tergerson and King (2002:376). Barriers that prevented 13-18-year-old adolescents (in the Western Cape) from participating in an intervention programme were, lack of time, duties at home, fears for their safety and lack of parental support (Pillay, 2005:98). Barriers that New Zealand adolescents experienced were that families provided easy access to sedentary activities, passive transportation modes, and schools that restricted access to the use of sporting equipment and the gymnasium at lunchtime (Hohepa *et al.*, 2006:331).

This literature review regarding barriers to PA indicated that the biggest barriers, for children and adolescents, to being physically active seemed to be time, other responsibilities, lack of access to facilities and school homework. Boys and girls also seemed to have different barriers and their physical activity patterns were influenced by their home environment and SES.

### **2.6.3 Factors that could motivate (encourage) adolescents to be more physically active**

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 deduced 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.

## 2.7 Chapter summary

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 according to their definitions 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 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.

The review of the literature also indicated that adolescents' perception of PA and PF could be inaccurate because of a lack of knowledge of PA and PF and the health benefits thereof. It seemed that if adolescents could be more educated on the aspects of a healthy lifestyle and the role that PA and PF played, they could be encouraged to be more physically active. The literature study also revealed that adolescents experienced a number of barriers which prevented them from being physically active. These barriers among children from low socio-economic environments included time, lack of facilities, too much homework and lack of funds. The research also revealed that the most important factor that would motivate boys was friends that could exercise with them, while girls indicated weight loss, and friends and parents that encourage them as the most important motivating factors.

With this literature study as a background, the results of this study will now be presented in the following chapters.

## 2.8 Reference list

ALLISON, K.R., DWYER, J.J.M., GOLDENBERG, E., FEIN, A., YOSHIDA, K.K. & BOUTILIER, M. 2005. Male adolescents' reasons for participating in physical activity, barriers to participation, and suggestions for increasing participation. *Adolescence*, 40(157):155-170, Spring.

ACSM (AMERICAN COLLEGE OF SPORTS MEDICINE). 2000. ACSM's guidelines for exercise testing and prescription. 6th ed. Philadelphia: Lippincott Williams & Wilkins. 368 p.

ANDERSON, R.E., CRESPO, C.J., BARTLETT, S.J., CHESKIN, L.J. & PRATT, M. 1998. Relationship of physical activity and television watching with body weight and level of fatness among children. *JAMA*, 279(12):938-942, March.

ARMSTRONG, N. 1992. New directions in physical education. Vol. 2. U.S. Champaign, ILL : Human Kinetics. 74 p.

BAQUET, G., VAN PRAAGH, E. & BERTHOIN, S. 2003. Endurance training and aerobic fitness in young people. *Sports medicine*, 33(15):1127-1143.

BARANOWSKI, T., BOUCHARD, C., BAR-OR, O., BRICKER, T., HEATH, G., KIMM, S.Y.S., MALINA, R., OBERZANEK, E., PATE, R., STRONG, W.B., TRUMAN, B. & WASHINGTON, R. 1992. Assessment, prevalence, and cardiovascular benefits of physical activity and fitness in youth. *Medicine & science in sports & exercise*, 24(6):S237-S247, Jun. Supplement.

BARANOWSKI, T., MENDLEIN, J., RESNICOW, K., FRANK, E., CULLEN, K. & BARANOWSKI, J. 2000. Physical activity and nutrition in children and youth: an overview of obesity prevention. *Preventive medicine*, 31(2):S1-S10, Aug.

BAR-OR, O., FOREYT, J., BOUCHARD, C., BROWNELL, K.D., DIETZ, W.H., RAVUSSIN, E., SALBE, A.D., SCHWENGER, S., ST. JEOR, S. & TORUN, B., 1998. Physical activity, genetic,

and nutritional considerations in childhood weight management. *Medicine & science in sports & exercise*, 30(1): 2-10.

BEETS, M.W. & PITETTI, K.H. 2004. One-mile run/walk and body mass index of an ethnically diverse sample of youth. *Medicine & science in sport & exercise*, 36(10):1796-1803.

BENNETT, G.G., WILIN, K.Y., VISWANATH, K., ASKEW, S., PULEO, E. & EMMONS, K.M. 2006. Television viewing and pedometer-determined physical activity among multiethnic residents of low-income housing. *American journal of public health*, 96(9):1681-1685.

BIDDLE, S.J.H., GORELY, T., MARSHALL, S.J., MURDEY, I. & CAMERON, N. 2003. Physical activity and sedentary behaviours in youth: issues and controversies. *The Journal of the royal society for the promotion of health*, 124(1):29-33.

BIDDLE, S.J.H. & MUTRIE, N. 2002. Psychology of physical activity: determinants, well-being and interventions. Great Brittan, Padstow: TJ International Ltd. 366 p.

BROWNSON, R.C., BAKER, E.A., BOYD, R.L., CAITO, N.M., DUGGAN, K., HOUSEMANN, R.A., KREUTER, M.W., MITCHELL, T., MOTTON, F., PULLEY, C., SCHMID, T.L. & WALTON, D. 2004. A community-based approach to promoting walking in rural areas. *American journal of preventive medicine*, 27(1):28-34, July.

CAMERON, N., GORDON-LARSON, P. & WRCHOTA, E.M. 1994. Longitudinal analysis of adolescent growth in height, fatness, and fat patterning in rural South African black children. *American journal of physical anthropology*, 93:307-321.

CAMERON, N., KGAMPHE, J.S., LESCHNER, K.F. & FARRANT, P.J. 1992. Urban-rural differences in the growth of South African black children. *Annals of human biology*, 19(1):23-33.

CAMERON, N., PREECE, M.A. & COLE, T.J. 2005. Catch-up growth or regression to the mean? Recovery from stunting revisited. *American journal of human biology*, 17(4):412-417.

CHAN, E.W.C., AU, E.Y.M., CHAN, B.H.T., KWAN, M.K.M., YIU, P.Y.P. & YEUNG, E.W. 2003. Relations among physical activity, physical fitness, and self-perceived fitness in Hong Kong adolescents. *Perceptual and motor skills*, 96(3):787-797, June.

CHENG, K.Y., CHENG, P.G., MAK, K.T., WONG, S.H., WONG, Y.K. & YEUNG, E.W. 2003. Relationship of perceived benefits and barriers to physical activity, physical activity participation and physical fitness in Hong Kong female adolescents. *The journal of sports medicine and physical fitness*, 43(4):523-529.

COETZEE, Z. 2003. Redes en hindernisse vir sportdeelname by hoërskoolleerlinge in die Potchefstroom-distrik. Potchefstroom : PU vir CHO. (Verhandeling – M.Sc.) 102 p.

COOLEY, D. & MCNAUGHTON, L. 1999. Aerobic fitness of Tasmanian secondary school children using the 20-m shuttle run test. *Perceptual and motor skills*, 18: 188-198.

COOPER, A.R., PAGE, A.S., FOSTER, L.J. & QAHWAJI, D. 2003. Commuting to school: are children who walk more physically active? *American journal of preventive medicine*, 25(4):273-276.

CROCKER, P.R.E., EKLUND, R.C. & KOWALSKI, K.C. 2000. Children's physical activity and physical self-perceptions. *Journal of sports sciences*, 18:383-394.

DEFLANDRE, A., ANTONINI, P.R. & LORANT, J. 2004. Perceived benefits and barriers to physical activity among children, adolescents and adults. *International journal of sport psychology*, 35:23-36.

DEPARTMENT OF EDUCATION, Education White Paper 3: a programme for the transformation of higher education (Notice 1196 of 1997, 24 July 1997, Pretoria), p.46.

ENGELBRECHT, C. 2001. Die verband tussen fisieke aktiwiteit en fisieke fiksheid van 13- tot 15-jarige dogters in die Noordwes-provinsie. Potchefstroom : PU vir CHO. (Verhandeling – M.A.) 103 p.

FAUCETTE, N., SALLIS, J.F., MCKENZIE, T.L., ALCARAZ, J., KOLODY, B. & NUGENT, P. 1995. Comparison of fourth grade students' out-of-school physical activity levels and choices by gender: project SPARK. *Journal of health education*, 26(2):S82-S90, March/April (Supplement).

FAULKNER, R.A. 1996. Maturation. In *Measurement in pediatric exercise science*. (Edited by D. Docherty). Measurement in pediatric exercise science. Champaign, Ill.: Human Kinetics. pp. 129-155

FLOHR, J.A. & WILLIAMS, J.A. 1997. Rural fourth graders' perceptions of physical fitness and fitness testing. *Physical educator*, 54(2):78-88. Spring.

FLOURIS, A.D., METSIOS, G.S., & KOUTEDAKIS, Y. 2006. Contribution of muscular strength in cardiorespiratory fitness tests. *The journal of sports medicine and physical fitness*, 46(2):197-201.

FOX, K.R., COOPER, A. & MCKENNA, J. 2004. The school and promotion of children's health-enhancing physical activity: perspectives from the United Kingdom. *Journal of teaching in physical education*, 23: 338-358.

FRANTZ, J.M. 2006. Physical inactivity as one of the chronic disease risk factors among high school learners in public schools in a local community in South Africa. *South African journal for research in sport, physical education and recreation*, 28(2):73-80.

FREEDSON, P.S. 1992. Physical activity among children and youth. *Canadian journal of sport science*, 17(4):280-283.

FREEDSON, P.S. & ROWLAND, T.W. 1992. Youth activity versus youth fitness: let's redirect our efforts. *Research quarterly for exercise and sport*, 63(2):133-136.

FRIEDMAN, J.F., PHILLIPS-HOWARD, P.A., MIREL, L.B., TERLOUW, D.J., OKELLO, N., VULULE, J.M., HAWLEY, W.A., NAHLEN, B.L. & TER KUILE, F. 2005. Progression of stunting and its predictors among school-aged children in western Kenya. *European journal of clinical nutrition*, 59:914-922.

GANLEY, T. & SHERMAN, C. 2000. Exercise and children's health. *The physician and sportsmedicine*, 28(2):85-92, Febr.

GORDON-LARSEN, P., GRIFFITHS, P., BENTLEY, M.E., WARD, D.S., KELSEY, K., SHIELDS, K. & AMMERMAN, A. 2004. Barriers to physical activity: Qualitative data on caregiver-daughter perceptions and practices. *American journal of preventive medicine*, 27(3):218-223.

GUTIN, B., YIN, Z., HUMPHRIES, M.C. & BARBEAU, P. 2005. Relations of moderate and vigorous physical activity to fitness and fatness in adolescents. *American journal of clinical nutrition*, 81:746-750.

HALL, P.A. & FONG, G.T. 2003. The effects of a brief time perspective intervention for increasing physical activity among young adults. *Psychology and health*, 18(6):685-706, Dec.

HAMLIN, M.J. & ROSS, J.J. 2005. Barriers to physical activity in young New Zealanders. *Youth studies Australia*, 24(1):31-37.

HANCOX, R.J., MILNE, B.J. & POULTON, R. 2004. Association between child and adolescent television viewing and adult health: a longitudinal birth cohort study. *The Lancet*, 364(9430):257-262, 17 July.

HEESCH, K.C., MÄSSE, L.C., DUNN, A.L., FRANKOWSKI, R.F. & MULLEN, P.D. 2003. Does adherence to a lifestyle physical activity intervention predict changes in physical activity? *Journal of behavioural medicine*, 26(4):333-348, Aug.

HOFFMAN, D.J., SAWAYA, A.L., COWARD, W.A., WRIGHT, A., MARTINS, P.A., DE NASCIMENTO, C., TUCKER, K.L. & ROBERTS, S.B. 2000. Energy expenditure of stunted and nonstunted boys and girls living in the shantytowns of São Paulo, Brazil. *The American journal of clinical nutrition*, 72:1025-1031.

HOHEPA, M., SCHOFIELD, G. & KOLT, G.S. 2006. Physical activity: what do high school students think? *Journal of adolescent health*, 39:328-336.

HOVELL, M.F., SALLIS, J.F., MCKENZIE, T.L. & KOLODY, B. 1999. Children's physical activity choices: a developmental analysis of gender, intensity levels, and time. *Pediatric exercise science*, 11:158-168.

JACKSON, A.W., MORROW, J.R., HILL, D.W. & DISHMAN, R.K. 1999. Physical activity for health and fitness: an individualized lifetime approach. Hong Kong: Human Kinetics. 366 p.

JACKSON, A.W., MORROW, J.R., HILL, D.W. & DISHMAN, R.K. 2004. Physical activity for health and fitness: updated edition. Champaign, Ill.: Human Kinetics. 368 p.

JAMNER, M.S., SPRUIJT-METZ, D., BASSIN, S. & COOPER, D.M. 2004. A controlled evaluation of a school-based intervention to promote physical activity among sedentary adolescent females: project FAB. *Journal of adolescent health*, 34:279-289.

JANSSEN, I., BOYCE, W.F., SIMPSON, K. & PICKETT, W. 2006. Influence of individual and area-level measures of socio economic status on obesity, unhealthy eating, and physical inactivity in Canadian adolescents. *The American journal of clinical nutrition*, 83:139-145.

JÜRIMÄE, T. & REGO, V. 2002 Relationships between physical activity, self-perceived and actual indicators of fitness in adolescents. *Kinesiology*, 34(2):163-168.

KEMPER, H.C.G., TWISK, J.W.R., KOPPES, L.L.J., VAN MECHELEN, W. & POST, G.B. 2001. A 15-year physical activity pattern is positively related to aerobic fitness in young males and females (13-27 years). *European journal of applied physiology*, 84:395-402.

KRISKA, A. 2000. Ethnic and cultural issues in assessing physical activity. *Research quarterly for exercise and sport*, 71(2):47-53.

KRUGER, A.S., MARGETTS, B.M. & VORSTER, H.H. 2004. Evidence of relatively greater subcutaneous fat deposition in stunted girls in the North-West province, South Africa, as compared with non-stunted girls. *Nutrition*, 20:564-569.

KRUGER, H.S. 2005. Stunted girls have greater subcutaneous fat deposits: what type of intervention can improve the health of stunted children? *Nutrition*, 21:1153-1155.

LESLIE, E., FOTHERINGHAM, K.J., OWEN, N. & BAUMAN, A. 2001. Age-related differences in physical activity levels of young adults. *Medicine & science in sport & exercise*, 33(2):255-258.

LUNN, P.G. 2002. Invited commentary: growth retardation and stunting of children in developing countries. *British journal of nutrition*, 88:109-110.

MALINA, R.M., BOUCHARD, C., BAR-OR, O. 2004. Growth, maturation and physical activity. II, USA : Human Kinetics. 712 p.

MARSH, H.W. & JOHNSON, S. 1994. Physical activity: relations to field and technical indicators of physical fitness for boys and girls aged 9-15. *Journal of sport & exercise psychology*, 16:83-101.

MARSHALL, S.J., BIDDLE, S.J.H., SALLIS, J.F., MCKENZIE, T.L. & CONWAY, T.L. 2002. Clustering of sedentary behaviours and physical activity among youth: a cross-national study. *Pediatric exercise science*, 14:401-417.

MARSHALL, S.J., SARKIN, J.A., SALLIS, J.F. & MCKENZIE, T.L. 1998. Tracking of health-related fitness components in youth ages 9 to 12. *Medicine & science in sports & exercise*, 30(6):910-916.

MARTINS, P.A., HOFFMAN, D.J., FERNANDES, M.T.B., NASCIMENTO, C.R., ROBERTS, S.B., SESSO, R. & SAWAYA, A.L. 2004. Stunted children gain less lean body mass and more fat mass than their non-stunted counterparts: a prospective study. *British journal of nutrition*, 92:819-825.

MATTON, I., THOMIS, M., WIJNDAELE, K., DUVIGNEAUD, N., BEUNEN, G., CLAESSENS, A.L., VANREUSEL, B., PHILIPAERTS, R., LEFEVRE, J. 2006. Tracking of physical fitness and physical activity from youth to adulthood in females. *Medicine and science in sports and exercise*, 38(6):1114-1120.

MAVRIDIS, G., FILIPPOU, F., ROKKA, S.T., BOUSIOU, S.T. & MAVRIDIS, K. 2004. The effect of a health-related aerobic dance program on elementary school children. *Journal of human movement studies*, 47:337-349.

McMURRAY, R.G., HARRELL, J.S., BANGDIWALA, S.I., BRADLEY, C.B., DENG, S. & LEVINE, A. 2002. A school-based intervention can reduce body fat and blood pressure in young adolescents. *Journal of adolescent health*, 31:125-132.

MEREDITH, M.D & WELK, G.J. 1999. Fitnessgram: test administration manual. Dallas, USA : Human Kinetics. 2<sup>nd</sup> ed. 121 p.

MILMAN, A., FRONGILLO, E.A., DE ONIS, M. & HWANG, J. 2005. Differential improvement among countries in child stunting is associated with long-term development and specific interventions. *The journal of nutrition*, 135:1415-1422.

MONYEKI, K.D., MONYEKI, M.A., TORIOLA, A.L., MAKGAE, P.J., BRITS, J.S., DE RIDDER, H.J., THEMANE, M.J. & AMUSA, L.O. 2005. Somatic characteristics and cardiovascular function in stunted rural South African girls aged 8 to 14 years: Ellisras longitudinal growth and health study. *African journal for physical, health education, recreation and dance*, 11(3):249-268, September.

MONYEKI, M.A., KEMPER, H.C.G., TWISK, J.W.R., MONYEKI, K.D., TORIOLA, A.L. & STEYN, N.P. 2003. Antropometric indicators of nutritional status and physical fitness of Ellisras rural primary school children, South Africa. *Medicina sportiva*, 7(EE3):E95-E104.

MYERS, L., STRIKMILLER, P.K., WEBBER, L.S. & BERENSON, G.S. 1996. Physical and sedentary activity in school children grades 5-8: the Bogalusa Heart Study. *Medicine and science in sports and exercise*, 28(7):852-859.

NAHAS, M.V., GOLDFINE, B. & COLLINS, M.A. 2003. Determinants of physical activity in adolescents and young adults: the basis for high school and college physical education to promote active lifestyles. *Physical educator*, 60(1). Available: Academic Search Premier.

NEUMARK-SZTAINER, D., STORY, M., HANNAN, P.J., THARP, T. & REX, J. 2003. Factors associated with changes in physical activity: a cohort study of inactive adolescent girls. *Archives of pediatrics & adolescent medicine*, 157:803-810. Aug.

NIEMAN, D.C. 1998. The exercise-health connection. Champaign, Ill: Human Kinetics. 317 p.

PANGRAZI, R.P., BEIGHLE, A., VEHIGE, T. & VACK, C. 2003. Impact of promoting lifestyle activity for youth (PLAY) on children's physical activity. *Journal of school health*, 73(8):317-321.

PASCHAL, A.M., LEWIS, R.K., MARTIN, A., DENNIS-SHIPPI, D. & SIMPSON, D.S. 2004. Baseline assessment of the health status and health behaviours of African-Americans participating in the activities-for-life program: a community-based health intervention program. *Journal of community health*, 29(4):305-318, Aug.

PATE, R.R., TROST, S.G., DOWDA, M., OTT, A.E., WARD, D.S., SAUNDERS, R. & FELTON, G. 1999. Tracking of physical activity, physical inactivity and health-related physical fitness in rural youth. *Pediatric exercise science*, 11:364-376.

PATE, R.R., TROST, S.G., FELTON, G.M., WARD, D.S., DOWDA, M. & SAUNDERS, R. 1997. Correlates of physical activity behaviour in rural youth. *Research quarterly for exercise and sport*, 68(3):241-248.

PAXTON, R.J., ESTABROOKS, P.A. & DZEWALTOWSKI, D. 2004. Attraction to physical activity mediates the relationship between perceived competence and physical activity in youth. *Research quarterly for exercise and sport*, 75(1):107-111.

PILLAY, T. 2005. Determining the effect of a short-term physical activity intervention programme on body mass index, blood pressure, pulse rate and percentage body fat among high school learners. Cape Town: University of the Western Cape. (Thesis – M.A.) 150 p.

- PLACEK, J.H., GRIFFIN, L.L., DODDS, P., RAYMOND, C., TREMINO, F. & JAMES, A. 2001. Chapter 3: Middle school students' conceptions of fitness: the long road to a healthy lifestyle. *Journal of teaching in physical education*, 20(4):314-323, July.
- PRINSLOO, A. & PIENAAR, A.E. 2003. Die voorkoms van DCD en die stand van fisieke fiksheid en fisieke aktiwiteit by plaaswerkerskinders: FLAGH-studie. Potchefstroom : PU vir CHO. (Verhandeling - M.A.) 102 p.
- PRISTA, A., MAIA, J.A.R. & MARQUES, A.T. 1997. The relationship between physical activity, socio-economic status and physical fitness of 8-15 year old youth from Mozambique. *American journal of human biology*, 9:449-457.
- PROCHASKA, J.J., SALLIS, J.F., SLYMEN, D.J. & MCKENZIE, T.L. 2003. A longitudinal study of children's enjoyment of physical education. *Pediatric exercise science*, 15:170-178.
- PRUSAK, K.A., TREASURE, D.C., DARST, P.W. & PANGRAZI, R.P. 2004. The effects of choice on the motivation of adolescent girls in physical education. *Journal of teaching in physical education*, 23:19-29.
- RAUDSEPP, L. & JÜRIMÄE, T. 1996. Physical activity, fitness, and adiposity of prepubertal girls. *Pediatric exercise science*, 8:259-267.
- RIDDOCH, C.J. & BOREHAM, C.A.G. 1995. The health-related physical activity of children. *Sports medicine*, 19(2):86-102.
- RINGUET, C.J. & TROST, S.G. 2001. Effects of physical activity intervention in youth: A review. *International sports medicine journal*, 2(5):1-10.
- ROEMMICH, J.N., GURGOL, C.M. & EPSTEIN, L.H. 2004. Open-loop feedback increases physical activity of youth. *Medicine & science in sport & exercise*, 36(4):668-673, April.
- ROMERO, A.J. 2005. Low-income neighbourhood barriers and resources for adolescents' physical activity. *Journal of adolescent health*, 36:253-259.

ROWLAND, T.W. 1990. Developmental aspects of physiological function relating to aerobic exercise in children. *Sports medicine*, 10(4):255-266.

ROWLAND, T.W. & FREEDSON, P.S. 1994. Physical activity, fitness and health in children: a close look. *Pediatrics*, 93(4):669-672, April.

ROWLAND, D., DIGUISEPPI, C., GROSS, M., AFOLABI, E., ROBERTS, I. 2003. Randomised controlled trial of site specific advice on school travel patterns. *Archives of disease in childhood*, 88(8):8-11.

SALLIS, J.F. & PATRICK, K. 1994. Physical activity guidelines for adolescents: consensus statement. *Pediatric exercise science*, 6:302-314.

SALLIS, J.F., ZAKARIAN, J.M., HOVELL, M.F. & HOFSTETTER, C.R. 1996. Ethnic, socio economic, and sex differences in physical activity among adolescents. *Journal of clinical epidemiology*, 49(2):125-134.

SAXENA, R., BORZEKOWSKI, D.L.G. & RICKERT, V.I. 2002. Physical activity levels among urban adolescent females. *Journal of pediatric and adolescent gynecology*, 15(5):279-284.

SAYED, I., MEYER, C.D.P. & MONYEKI, A. 2004. Barriers to sports and recreation participation in three communities in Botswana. *African journal for physical, health education, recreation and dance*, 10(4):306-316, Dec.

SHARKEY, B.J. 2002. Fitness & health. Hong Kong: Human Kinetics. 437p.

SHROPSHIRE, J. & CARROL, B. 1998. Final year primary school children's physical activity levels and choices. *European journal of physical education*, 3(2):156-166.

TERGERSON, J.L. & KING, K.A. 2002. Do perceived cues, benefits, and barriers to physical activity differ between male and female adolescents? *Journal of school health*, 72(9):374-380.

TROST, S.G., PATE, R.R., WARD, D.S., SAUNDERS, R. & RINER, W. 1999. Determinants of physical activity in active and low-active, sixth grade African-American youth. *Journal of school health*, 69(1):29-34. Available: Academic Search Premier.

TROST, S.G., WARD, D.S., MCGRAW, B. & PATE, R.R. 1999. Validity of the previous day physical activity recall in fifth-grade children. *Pediatric exercise science*, 11:341-348.

TUDOR-LOCKE, C., AINSWORTH, B.E. & POPKIN, B.M. 2001. Active commuting to school: an overlooked source of childrens' physical activity? *Sports medicine*, 31(5):309-313.

VAN DEVENTER, K.J. 1998/99. The state of participation in physical activities by high school learners: a survey in some Western Cape schools involving learners, teachers and parents. *South African journal for research in sport, physical education and recreation*, 21(2):89-102.

WALSH, C.M., DANNHAUSER, A. & JOUBERT, G. 2002. The impact of a nutrition education programme on the anthropometric nutritional status of low-income children in South Africa. *Public health nutrition*, 5(1):3-9.

WANG, C.K.J. & BIDDLE, S.J.H. 2001. Young people's motivational profiles in physical activity: a cluster analysis. *Journal of sport & exercise psychology*, 23:1-22.

WELK, G.J. & WOOD, K. 2000. Physical activity assessments in physical education: a practical review of instruments and their use in the curriculum. *The journal of physical education, recreation & dance*, 71(1):30-40, January.

WILDSCHUTT, P.J. 2005. The effect of accumulative physical activity on the fitness and health status of rural school children. Cape Town: University of the Western Cape. (Thesis – M.A.) 176 p.

WINNICK, J.P. 2005. Adapted physical education and sport. Champaign, Ill.: Human Kinetics. 573 p.

WHO (World Health Organisation), 2000. [Web:] [www.WHO.org](http://www.WHO.org) [Date of use: 5 June 2007].

ZAKARIAN, J.M., HOVELL, M.F., HOFSTETTER, R., SALLIS, J.F. & KEATING, K.J. 1994.  
Correlates of vigorous exercise in a predominantly low SES and minority high school  
population. *Preventive medicine*, 23:314-321.

# CHAPTER 3

**Physical fitness and physical activity status of 15-year-old adolescents in a semi-urban community**



Physical fitness and the physical activity status of 15-year-old adolescents in a semi-urban  
community

Fisieke fiksheid en die fisieke aktiwiteit status van 15-jarige adolessente van 'n semi-stedelike  
gemeenskap

ANITA LENNOX, ANITA E. PIENAAR & CILAS WILDERS

School of Biokinetics, Recreation and Sport Science, North-West University, Potchefstroom  
Campus, Private Bag X6001, Potchefstroom, 2520, Republic of South Africa

Correspondence Author:

Prof A.E. Pienaar

School of Biokinetics, Recreation and Sport Science, North-West University Potchefstroom  
Campus, Private Bag X6001, Potchefstroom, 2520, Republic of South Africa

Tel: (018 299 1796)

Fax: (018 299 1796)

E-mail: [anita.pienaar@nwu.ac.za](mailto:anita.pienaar@nwu.ac.za)

Short title: Physical activity and physical fitness

Physical fitness and the physical activity status of 15-year-old adolescents in a semi-urban community

**Abstract**

Continuous research with regards to physical activity and physical fitness patterns of children is essential for the development and implementation of health promotion programmes. This study aimed to determine the physical fitness (PF) and physical activity (PA) status of 15-year-old adolescent learners from a low socio-economic, semi-urban community in the North-West province of South Africa, and the relationships between PF, PA and distances the children walked to school. Grade 8 learners from two schools were selected for the study: School 1 (N=252), 116 boys; 136 girls (intervention school), School 2 (N=66), 21 boys; 45 girls (control school). The testing protocol included fitness tests for aerobic endurance, strength, flexibility and body composition and the PDPAR (Previous Day Physical Activity Recall) questionnaire to determine physical activity levels. The results indicated that the boys and girls in School 1 and boys in School 2 were moderately active, while the girls in School 2 showed a significantly lower PA level. Longer commuting distances and higher mean physical fitness values were found in School 1, while more hours of watching television were found among boys and girls ( $p < 0.05$ ) in School 2. Poor strength levels, falling outside the healthy fitness zone, showed negative relationships with aerobic fitness and flexibility. Television viewing time and commuting distances to school appeared to have a moderate influence on the moderate to low PA levels of the total group, and physical activity showed a relationship with higher fitness values. It is recommended that activity intervention strategies must aim to empower adolescents with knowledge and skills to enable them to improve their PA levels and strength.

Key words: Physical Fitness, Physical Activity, Adolescents, Low Socio-economic Environment

## Introduction

Physical fitness (PF) and physical activity (PA) are considered to be important supportive elements for the maintenance and enhancement of health and quality of life, and hence for the improvement of the holistic development of a child (Pate *et al.*, 1999; Baranowski *et al.*, 2000). Low levels of PA and PF are associated with various health-risk factors (Pate *et al.*, 1999; Sharkey, 2002), whilst higher levels of PA are associated with enduring health and vitality (Hall & Fong, 2003).

The literature indicates that there is a decline in the levels of PA among boys and girls during their teenage years and into early adulthood (Kemper, *et al.*, 2001; Leslie *et al.*, 2001; Neumark-Sztainer *et al.*, 2003). Engelbrecht (2001) reported in this regard that 73.3% of girls between the ages of 13-15-years-old in the North-West Province of South Africa had low activity levels, and significant decreases of activity levels with increasing age up to 15 years were also found in the group. It was also indicated by researchers (Pate *et al.*, 1999; Sharkey, 2002) that there was a relationship between PA levels during childhood and adulthood. Kriska (2000) and Prinsloo and Pienaar (2005) indicated that greater domestic responsibilities of children from low socio economic environments contributed to higher levels of energy expenditure and hence higher levels of PA among them. In addition, children from rural environments usually walked to school, mainly because of financial constraints. In this regard, significantly higher levels of physical activity were reported among children in rural environments who walked to school compared to those using other forms of transport (Tudor-Locke *et al.*, 2001; Cooper *et al.*, 2003; Hamlin & Ross, 2005).

Minimum standards for physical fitness, which must be attained by children and adolescents with regard to physical fitness performance, and which serve as a guideline to obtaining full health advantages from their physical fitness status are described by Meredith and Welk (1999). 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).

Little is known about the physical fitness and physical activity status of adolescents from lower socio-economic environments. The purpose of this study was, firstly, to analyse the physical fitness and physical activity levels of 15-year-old adolescent boys and girls from a previously disadvantaged community. This analysis includes establishing whether their PF status falls within the HFZ as reported in the Fitnessgram measuring instrument (Meredith & Welk, 1999). A second aim was to determine which of the PF components made the biggest contribution to the group's PA status, as this information is important to determine the content and the focus of health-enhancing physical activity intervention programmes for adolescents.

## **Methods**

### *Research Design*

A two-group pre-test and post-test research design was used. This research forms part of the multi-disciplinary and longitudinal PLAY study (*Physical Activity in Youth*), of which the overall purpose is to investigate the effect of a physical activity intervention programme (PAIP) for adolescents and to determine whether exercise will effect physical activity and physical fitness and specifically, retarded growth (stunting). This study is based on a cross-sectional study design. Two secondary schools in Ikageng (a semi-urban area) in the Potchefstroom area of the North-West Province of South Africa were selected for the research. The children, whose parents granted informed consent for participation in the study, were tested by a multi-disciplinary team to obtain the following data: demographic information, physical activity levels, physical fitness and anthropometric data. The study protocol was approved by the Ethics Committee of North-West University (04M01) in Potchefstroom.

### *Sample*

A high school near the intervention school (School 1) was chosen as a control group (School 2) and had a slightly better socio-economic status (SES), determined by income per capita, housing, water and electricity, indicating that this school was financially better off and that the nutritional status of learners was possibly better than that of the learners in School 1. All the learners in Grade 8 in School 1 and 2 were requested to participate in the research. Two hundred and fifty-two (N=252) Grade 8 learners (116 boys and 136 girls) in School 1 and N=66 Grade 8 learners (21 boys and 45 girls) in School 2 were granted informed consent by their

parents to participate in the study. No physical education or organised sport was part of the curricula presented at the two schools.

### **Measuring instruments**

#### *The Previous Day Physical Activity Recall (PDPAR)*

The PDPAR compiled by Trost *et al.* (1999) was used in the study to analyse the physical activity levels of the children for a previous weekday and one day during the previous weekend. The questionnaire reported activities for every 30 minute intervals during the day. The activities were classified in the following categories:

- A. Grooming (i.e. eating, drinking, sitting quietly, sleeping, taking shower, bathing and washing);
- B. Transport (motor, bus, walking slowly and fast, walking uphill and downhill, cycling slowly);
- C. Working indoors (i.e. homework, house chores, washing dishes, cooking, putting away groceries, shopping, washing clothes, ironing, making bed);
- D. Working outdoors (i.e. carrying and loading wood, chopping wood and making fire, fetching water, clearing land, digging sandbox, gardening with tools, laying crushed rock, digging, spading, mowing lawn, planting seedlings, raking lawn, trimming shrubs, watering garden);
- E. Recreational activities (i.e. watching TV, going to movies, concerts, assembly, listening to music, sitting and playing cards, drawing, writing, reading books, talking on phone, studying, playing piano);
- F. Organised physical activity (jogging, dancing);
- G. Sport (i.e. basketball, boxing, soccer);
- H. Recreational games (i.e. hopscotch, marbles, roller-skates, play hide and seek, church);
- I. Other activities (making tea, polishing shoes, dressing).

Each activity was assigned a METs (Metabolic Equivalent = 1 MET is the energy consumption associated with rest and equal to 1 kkal/kg/uur, sleep = 0.9) value and the intensity of the activities recorded were also categorised as High (3), Medium (2) or Low (1). According to this information each learner was classified as highly active (3), moderately active (2) and low active (1). Television viewing hours were calculated by adding all the half hours that had been recorded and the number of hours was used in analysing the data.

A number of adjustments were made to make the activities more compatible with South African cultural differences. Certain traditional games of Tswana children, with a MET value for each activity, were added to the list of activities (for example Bortjie – 2.5, Kaizer – 3.0).

### *Body composition*

Body mass was measured with an electronic scale, to the nearest 0.1 kg, and stature was measured with a stadiometer to the nearest 0.5 cm. Body mass index (BMI) was calculated by the following formula:  $BMI = \text{Weight (kg)} / [\text{Height (cm)}]^2$ . Four skin folds were measured, namely the triceps, sub-scapular, calf and abdominal skin folds. These were measured to the nearest 0.5 mm using Harpenden calipers. Stunting (height-for-age) was calculated according to the definition of the World Health Organisation (WHO) and recorded as a height-for-age Z score  $\leq -2.0$  (Human Energy Requirements, 2001). Two methods were used to determine body fat percentage, namely the BOD POD (Body Composition System, 2003) and by using the following skinfolds (the calf, triceps and abdominal skin folds) as required by Meredith and Welk (1999) in the Fitnessgram. The BOD POD is a reliable and valid method which makes use of the basis of total body density to determine the quantity of body fat and slender body mass (BOD POD, 2003). The Fitnessgram method to determine fat percentage was mainly included to determine the HFZ. However, a correlational analysis revealed a high correlation between the two methods ( $r$  value varied between  $r = 0.71$  and  $0.81$ , pre- and post-testing).

### *Fitnessgram*

The *Fitnessgram* (Meredith & Welk, 1999) is a physical fitness test battery by means of which the health-related fitness of children from five to 17 years and older can be measured. The *Fitnessgram* measures cardiovascular fitness, muscular endurance, strength and flexibility and body composition by means of a number of tests. These include the following:

*PACER (boys and girls)*: This test measures aerobic capacity and is determined by a 20m multi-stage shuttle run, with a progressive increase in pace. When a participant can no longer complete a lap within the required time, he/she is stopped and the number of completed 20m laps are recorded.

*Curl-ups (boys and girls)*: This test measures abdominal strength and endurance. The objective is to do as many curl-ups as possible at a predetermined rate of one curl-up every three seconds. An age-appropriate measuring strip was used to ensure the correct execution of the curl-ups. The score is the number of correct curl-ups performed.

*Trunk lift (boys and girls):* This test measures trunk extensor strength and flexibility. The objective is to raise the torso as high as possible from the floor from a prone position, while keeping the eyes on an object in line with the eyes on the floor. This position is held while the distance from the floor to the chin is measured in centimeters.

*Push-ups (boys and girls):* This test measures upper body strength and endurance. The participant has to do as many push-ups (where the torso must touch the floor with each push-up) as possible at a predetermined rate of approximately 20 push-ups per minute or one every three seconds. The total number of push-ups is recorded.

*Pull-ups (boys):* This test measures upper body muscle strength. The objective of the test is to do as many pull-ups from a straight hanging position on a bar. The correct number of pull-ups (which require that the chin must be above the bar), is recorded (Meredith & Welk, 1999).

*Flexed arm hang (girls):* This test measures arm and shoulder strength and endurance. Girls have to hang with bent arms and the chin above the bar for as long as possible. The number of seconds that the chin remains above the bar is recorded (Meredith & Welk, 1999).

*Back saver sit-and-reach (boys and girls):* This test measures the flexibility of the lower back and hamstrings. The flexibility of the right-leg and left-leg are measured separately. It is required to sit at the sit-and-reach box with the sole of the left foot against the box and the right foot flat on the floor with the right knee bent. Sit with arms forward with one hand over the other, palms facing downwards, resting on the measuring tape of the box. The participant has to stretch four times as far forward as possible, and hold the position for one second during the fourth attempt. The farthest distance which can be reached is recorded in centimeters (Meredith & Welk, 1999).

The Fitnessgram uses criterion-referenced standards to establish fitness status. Scores are classified in two main areas which are the Needs Improvement Zone (or at-risk-fitness) and the HFZ. Everybody should strive to be classified into the HFZ which includes a range of scores in each of the tests.

#### *Additional physical fitness tests*

These tests were done to compare this results with other studies and to get better insight in the adolescence physical fitness and consisted of the following measurements:

*Left and right hand grip strength:* This was measured by the Lafayette-hand grip dynamometer (Wood, 1997). The dynamometer was held in each hand separately, parallel with the leg and

the participant had to squeeze it as hard as possible, after which the score was recorded in kilogram.

*Standing long jump:* The participant stood feet slightly apart (toes behind a starting line) and jumped forward as far as possible. Two trials were given and the farthest distance was measured in centimeter from the starting line to the heel of the foot nearest to this line (Wood, 1997).

*Modified sit-and-reach:* This test measured the flexibility of the lower back and hamstrings by means of a standard box and metre stick (Docherty, 1996). The participant sat with both feet against the standard box and with the hands on top of each other with a straight back against a wall. The distance was measured from the starting line to the tip of the fingertips (cm). The participant was then asked to reach as far as possible and hold the position for three seconds. The distance was measured and deducted from the first measurement.

#### *Demographic information*

Information about the socio-economic status (SES) and mode of travel to school of each participant was obtained through a questionnaire. The questionnaire, based on a five-point Likert scale, determined the availability of water, sanitation and electricity in their houses. Participants also had to provide information stating their mode of travel to school, distance walked to school and the time they started walking to school in the mornings.

#### **Data analysis**

Data was analysed by means of the Statistica for Windows (StatSoft, 2004) computer programme. Descriptive statistics were computed (means, standard deviations and minimum and maximum values). Dependent t-testing was done to analyse differences ( $p < 0.05$  was accepted as a significant difference) between the genders and the schools, while correlation matrices were used to determine relationships between variables.

#### **Results**

The various distances which the learners walked to school are displayed in Table 1. The main objective of this analysis was to establish what percentage of the learners walked to school. It revealed that 96.4% of the learners of School 1 and 92.4% of the learners of School 2 walked to school. Learners from School 1 walked longer distances than those from School 2 where only one (1.5%) walked between 3 and 5 km. In contrast, the majority of the learners from

School 1 (50.8%) walked between 3 and 5 km. These learners carried very little to school and therefore it was not felt necessary to report any information regarding this.

TABLE 1. Distances walked to school by learners from both schools

Walking distance	School 1		School 2	
	<i>N</i>	%	<i>N</i>	%
500 m - 2 km	89	35.3	65	98.5
3 km – 5 km	128	50.8	1	1.5
6 km - 10 km	27	10.7	0	0

Tables 2-5 display the body composition and physical fitness characteristics regarding the PA and PF of the learners. Table 2 presents descriptive information about the body composition of the boys and the girls from School 1 and School 2, as well as significant differences between the two schools.

Although all the participants in the study were learners in Grade 8, significant differences were found in the mean ages of the boys of the two schools (School 1 = 15.11 years, School 2 = 13.67 years) [Table 2]. Significant differences were also found between the boys from the two schools in their stature, sub-scapular and triceps skin folds and percentage body fat. Although the boys from School 1 were significantly older and taller than those from School 2, the boys from School 2 had bigger sub-scapular and triceps skin folds as well as a higher percentage body fat ( $p = 0.020$ ) [Table 2].

Significant differences were also found in the body composition of the girls (Table 2). Although the girls from School 1 were, like the boys, significantly older than School 2 ( $M = 14.46$ , vs.  $M = 13.93$ ), they weren't as tall and weighed less, although not significantly. The sub-scapular and triceps skin folds as well as percentage body fat were however, significantly higher than was found in School 1.

Due to the older age of the girls from School 1 (Table 2), it was expected that they would have greater percentages of fat than girls from School 2, but the opposite was the case. The height-for-age Z-scores of the girls ( $M = -1.10$ ) in School 1 was also significantly higher than School 2 ( $M = -0.75$ ), indicating that a greater percentage of the girls in School 1 were stunted.

TABLE 2. Descriptive data and significance of differences between the anthropometrical characteristics of boys and girls in Schools 1 and 2

Variables	Mean	SD	Min	Max	Mean	SD	Min	Max	p
<b>Boys</b>	<b>School 1 (n=116)</b>				<b>School 2 (n=21)</b>				
Age	15.11	1.39	13.00	21.00	13.67	0.58	13.00	15.00	.000*
Stature	159.00	9.47	138.50	180.50	152.09	7.92	134.90	173.10	.002*
Body mass	45.99	10.21	10.00	78.15	42.20	9.15	29.30	64.00	.114
BMI	18.28	3.27	13.18	40.31	17.67	2.92	12.80	25.77	.423
HAZ-score	-1.18	0.97	-3.61	1.66	-1.20	1.04	-3.23	1.44	.927
Sub-scapular skinfold	6.84	2.71	3.50	29.10	9.22	7.58	4.90	39.50	.010*
Triceps skinfold	8.42	3.59	3.70	25.00	10.25	4.71	4.60	23.90	.044*
Calf skinfold	10.42	5.66	4.20	48.10	11.28	4.28	4.90	20.80	.510
Abdominal skinfold	9.90	6.42	3.6	58.10	11.86	8.53	5.80	38.10	.225
BOD POD fat %	19.25	7.29	7.00	51.70	21.65	6.96	15.60	42.50	.261
Percentage fat	21.07	7.07	9.80	40.30	25.53	11.94	12.80	62.50	.020*
<b>Girls</b>	<b>School 1 (n=136)</b>				<b>School 2 (n=45)</b>				
Age	14.46	1.93	12.00	18.00	13.93	1.19	12.00	18.00	.022*
Stature	153.62	6.27	138.70	172.10	154.80	7.05	129.70	167.70	.293
Body mass	45.75	8.22	31.50	73.50	48.12	12.57	22.10	85.50	.148
BMI	19.34	3.25	11.18	31.30	19.96	4.86	13.15	38.72	.329
HAZ-score	-1.10	0.91	-3.25	1.47	-0.75	0.92	-3.69	1.08	.029*
Sub-scapular skinfold	10.13	4.53	5.20	36.80	12.60	7.95	5.00	47.50	.011*
Triceps skinfold	13.07	4.92	6.30	38.00	16.53	6.66	6.30	34.70	.000*
Calf skinfold	16.04	5.40	5.80	32.90	16.77	6.04	5.00	32.50	.450
Abdominal skinfold	15.17	6.19	5.30	35.20	16.40	7.21	5.60	33.50	.320
BOD POD fat %	27.77	6.42	13.30	47.90	31.17	8.13	21.60	54.90	.031*
Percentage fat	28.66	8.80	13.20	57.80	35.28	10.73	16.70	57.10	.000*

Min = Minimum values, Max = Maximum values, SD = standard deviation, p = p-value, significance (\*) =  $p \leq 0.05$ , BMI = Body Mass Index, HAZ-score = Height-for-age Z score ( $\leq -2.0$ )

TABLE 3. Descriptive data and significance of differences between the physical fitness and physical activity of the boys and girls in Schools 1 and 2

<b>Variables</b>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>p</i>
<b>Boys</b>	<b>School 1</b>				<b>School 2</b>				
Aerobic fitness	50.02	16.01	2.8	92.0	43.24	13.04	14.0	64.0	.069
Sit-and-reach-R	28.97	7.64	15.0	43.0	27.50	7.54	20.0	36.0	.215
Sit-and-reach-L	29.05	5.63	10.0	56.5	27.64	5.30	18.0	43.0	.331
Mod. sit-and-reach	31.60	5.01	15.0	45.5	29.45	4.82	20.0	39.5	.138
Trunk strength/ flexibility	19.93	6.15	9.0	31.0	22.76	5.73	15.0	29.0	.008*
Curl-ups	7.57	6.13	1.0	44.0	6.71	5.76	0.0	32.0	.637
Push-ups	7.32	2.06	1.0	27.0	5.67	1.42	0.0	17.0	.212
Pull-ups	1.54	4.41	0.0	10.0	1.14	4.47	0.0	4.0	.396
Standing long jump	144.39	22.63	26.8	193.6	153.62	14.67	127.4	175.3	.074
Hand grip strength R	27.77	7.20	15.5	49.0	23.10	4.05	16.0	34.0	.005*
<b>Boys</b>	<b>School 1</b>				<b>School 2</b>				
PA week	2.44	0.77	1.0	3.0	2.43	0.81	1.0	3.0	.952
PA weekend	2.39	0.82	1.0	3.0	2.20	0.90	1.0	3.0	.606
TV-hrs week	1.92	1.43	0.0	5.5	2.24	1.27	0.0	4.5	.345
TV-hrs weekend	<b>3.31</b>	2.10	0.0	9.5	3.62	2.50	0.0	9.5	.553
<b>Girls</b>	<b>School 1</b>				<b>School 2</b>				
Aerobic fitness	25.58	10.04	3.0	60.0	21.36	8.09	8.0	45.0	.013*
Sit-and-reach-R	31.11	5.54	14.0	43.0	29.08	3.98	14.0	43.0	.035*
Sit-and-reach-L	31.54	2.85	16.5	43.5	28.63	1.81	13.0	41.0	.002*
Mod. Sit-and-reach	33.25	5.37	17.0	46.5	29.98	6.09	12.0	45.0	.005*
Trunk strength/ flexibility	19.55	5.41	8.0	32.0	18.90	5.55	12.0	26.0	.399
Curl-ups	4.96	6.41	1.0	26.0	4.18	7.58	1.0	21.0	.387
Push-ups	2.40	2.56	0.0	18.0	1.61	4.35	0.0	11.0	.086
Flexed arm hang	1.66	4.78	0.0	13.0	1.51	3.14	0.0	27.0	.777
Standing long jump	129.63	14.24	75.3	172.7	129.59	11.41	110.2	170.2	.987
Hand grip strength R	22.62	4.62	6.0	34.0	22.69	4.66	12.0	33.0	.934
<b>Girls</b>	<b>School 1</b>				<b>School 2</b>				
PA week	2.04	0.85	1.0	3.0	1.67	0.83	1.0	3.0	.011*

PA weekend	2.01	0.90	1.0	3.0	1.58	0.72	1.0	3.0	.004*
TV-hrs week	1.76	1.32	0.0	5.5	2.53	1.38	0.0	5.5	.001*
TV-hrs weekend	2.74	1.94	0.0	9.0	3.28	2.38	0.0	10.0	.132

Min = Minimum values, Max = Maximum values, SD = Standard deviation,  $p$  = p-value, significance (\*) =  $p \leq 0.05$ , PA week = Physical activity level of the week, PA weekend = Physical activity level of the weekend, Mod. sit-and-reach = Modified sit-and-reach

Table 3 shows that the PF status of boys in Schools 1 and 2 were similar. Significantly better trunk strength and flexibility were found in School 2 boys, whilst School 1 boys had better hand grip strength. Although not at the 5% level of significance, the boys from School 1 demonstrated marginally significantly better aerobic fitness values ( $p = 0.069$ ) than School 2, whilst the boys in School 2 had better leg strength values ( $p = 0.074$ ) than boys in School 1.

Table 3 showed that girls from School 1 obtained significantly higher values in aerobic fitness and sit-and-reach with the left and the right legs. It thus appeared that boys and girls from School 1 had better aerobic fitness, which could possibly be attributed to the fact that they walked further distances to school, compared to the boys and girls from School 2 (Table 1). However, from a maturity point of view the higher mean age of this group of boys might also have contributed to the above mentioned results.

The analysis in Table 3 indicates no significant differences in the PA levels of the boys of the two schools. The boys from both schools were classified as moderately active during the week and weekend, while boys from School 2 watched more television during the week as well as the weekend. The girls from School 1 were moderately active and also significantly more active compared to the girls from School 2, who were classified as being in the low active category during the week and the weekend. The girls in School 2 indicated more hours watching television during the week and weekend, although only at a significant level during the week ( $p = 0.001$ ). The longer distances that the learners from School 1 walked to school and the higher physical activity levels during the week and weekend, might have contributed to the higher activity levels of the boys and girls in School 1.

Table 4 displays the results of how the learners' PF compared with the health benefiting standards of the "Fitnessgram" (Meredith & Welk, 1999). The HFZ have age and gender related standards for each variable.

TABLE 4. The physical fitness of boys and girls from Schools 1 and 2 according to the Fitnessgram's health-benefiting standards (HFZ)

Variables	School 1		School 2	
	Mean	HFZ	Mean	HFZ
<b>Boys</b>				
Percentage fat	21.07	HFZ	25.53	RFZ
BMI	18.28	HFZ	17.67	HFZ
Aerobic fitness	50.02	HFZ	43.24	HFZ
Sit-and-reach-right	28.97	HFZ	27.50	HFZ
Sit-and-reach-left	29.05	HFZ	27.64	HFZ
Trunk flexibility	19.93	RFZ	22.76	RFZ
Curl-ups	7.57	RFZ	6.71	RFZ
Push-ups	7.32	RFZ	5.67	RFZ
Pull-ups	1.54	RFZ	1.14	HFZ
<b>Girls</b>				
Percentage fat	28.66	HFZ	35.28	RFZ
BMI	19.34	HFZ	19.96	HFZ
Aerobic fitness	25.58	HFZ	21.36	RFZ
Sit-and-reach-right	31.11	HFZ	29.08	HFZ
Sit-and-reach-left	31.54	HFZ	28.63	HFZ
Trunk flexibility	19.55	RFZ	18.90	RFZ
Curl-ups	4.96	RFZ	4.18	RFZ
Push-ups	2.40	RFZ	1.61	RFZ
Flexed arm hang	1.66	RFZ	1.51	RFZ

HFZ = Healthy Fitness Zone, RFZ = Risky Fitness Zone (At-risk fitness zone), BMI = Body Mass Index

In Table 4 the boys from School 1 fall within the HFZ with regard to the percentage body fat, BMI, aerobic fitness, and sit-and-reach (right and left). Regarding School 2, BMI, aerobic fitness, sit-and-reach (right and left) and pull-ups are all categorised in the HFZ. It appears that the boys in both schools have poor strength values (curl-ups, push-ups, pull-ups), seeing that all these PF components (except for the pull-ups in School 2, Table 4), fall into the at-risk fitness zone. The HFZ regarding body fat percentages for boys and girls are indicated respectively as 17-32% and 10-25% in the Fitnessgram, although within this zone, 25-32% is indicated as moderately to high fat percentages for girls and 20-25% for boys. The mean fat

percentages of both the girls and the boys are therefore considered as moderately high. The percentages body fat determined by the BOD POD, which correlated highly with the Fitnessgram method ( $r = 0.71$  and  $r = 0.81$ ) were however somewhat lower. Cut-off points found in the literature for overweight and obesity would have classified boys from School 2 and girls from both schools in the overweight category.

Table 4 indicates that five of the PF variables (percentage fat, BMI, aerobic fitness, sit-and-reach (right and left) of the girls in School 1 fall into the HFZ. Only the BMI and sit-and-reach (right and left) of the girls from School 2 place them in this zone. It appears that, like the boys, the girls also have poor strength values, since both schools fall into the at-risk fitness zone. The aerobic fitness of the boys and the girls from School 1 fell into the HFZ, which were not the case with the girls in School 2.

In the next section Table 5 provides an analysis of possible relationships between PA and PF. In the case of the boys low but significant relations were found between physical activity during the week, skin folds, body mass, percentage fat ( $r = -0.24$ ) and hours watching television ( $r = -0.28$ ). This indicates that the higher the PA, the lower the percentage fat and the fewer the hours spent watching television. The PA level during the weekend correlates significantly with the distance ( $r = 0.19$ ) walked to school, as well as with abdominal muscle strength and PA during the week. Significant but also low inverse relations were found among the girls, between PA of the week and sub-scapular ( $r = -0.21$ ) and triceps ( $r = -0.23$ ) skin folds, and with PA during the weekend. This indicates that more active girls have smaller skin folds. Physical activity of girls during the weekend correlates significantly with standing long jump ( $r = 0.22$ ), indicating that higher PA levels are related to better leg strength.

TABLE 5. Relationships between physical activity and physical fitness

Total group	Total group			Boys				Girls				School 1			School 2		
	W	WE	Dist	W	WE	Dist	Pull-ups	W	WE	Dist	Armhang	W	WE	Dist	W	WE	Dist
Age	.05	-.00	.12	.03	-.11	.19*	.44*	-.04	-.03	-.01	-.06	.01	-0.09	.02	.11	.23	.04
Time	.06	-.04	.50*	.02	.04	.45*	.12	.08	-.14	.56	-.02	.08	-0.02	.61*	-.08	-.20	-.15
Place	.14	.15*	.98*	.05	.21*	.98*	.04	.18	.18	.98	.02	.09	0.09	.97*	.00	-.14	1.00*
Stature	.05	-.06	.14	-.07	-.17	.21*	.10	.11	-.06	-.06	-.09	.04	-0.06	.11	.03	-.19	-.02
Mass	-.10	-.14*	.07	-.11	-.16	.17	.18	-.07	-.08	-.06	-.31*	-.10	-0.13	.11	-.06	-.17	.14
BMI	-.19*	-.18*	.00	-.22*	-.16	.04	.10	-.08	-.10	.02	-.29*	-.19*	-.18*	.04	-.16	-.12	.16
Sub-scapular skinfold	-.27*	-.22*	-.08	-.20*	-.14	-.12	-.03	-.21*	-.13	.03	-.32*	-.23*	-.17*	.07	-.34	-.25	.19
Triceps skinfold	-.30*	-.19*	-.13	-.23*	-.01	-.04	-.28*	-.23*	-.13	-.14	-.37*	-.24*	-.08	.02	-.42*	-.41*	.27
Calf skinfold	-.24*	-.12	-.09	-.18	.05	-.09	-.25*	-.12	-.01	.01	-.39*	-.19*	-.04	-.04	-.39*	-.39*	.27
Abdominal skinfold	-.27*	-.21*	-.10	-.21*	-.04	-.07	-.16	-.19	-.18	-.06	-.30*	-.24*	-.17*	.02	-.30	-.22	.12
Fat % BP	-.21*	-.11	-.13	-.09	.04	-.10	-.40*	-.11	.05	-.05	-.36*	-.12	-.02	-.06	-.55*	-.47*	.28
Percentage fat	-.30*	-.20*	-.11	-.24*	-.01	-.07	-.25*	-.21	-.15	-.07	-.40*	-.25*	-.11	.00	-.38*	-.38*	.41*
Aerobic fitness	.23*	.23*	.13	.10	.09	.06	.26*	.18	.12	.16	.38*	.16	.16*	.00	.50*	.51*	-.22
Sit-and-reach-R	-.16*	-.08	-.07	-.13	-.00	.08	.22*	-.10	-.04	-.19	.15	-.16*	-.04	-.06	-.12	-.24	.18
Sit-and-reach-L	-.16*	-.13	.06	-.18	-.05	.21*	.13	-.03	-.11	-.09	.23*	-.16*	-.11	.05	-.19	-.29	.08
Mod. sit-and-reach	-.14*	-.13	.08	-.16	-.09	.17	.21*	-.06	-.10	.01	.21	-.17*	-.12	.08	-.02	-.22	.11
Trunk flexibility	-.06	-.01	-.01	-.03	.06	-.10	-.02	-.18	-.20	.09	.10	-.09	.01	.10	.20	.03	-.30
Curl-ups	.09	.13	.10	.01	.20*	.07	.07	.10	-.18	.11	.12	.05	0.13	.07	.26	.03	-.04
Push-ups	.13	.19*	.06	.00	.08	.03	.50*	.08	.06	-.05	.43*	.09	.14	-.01	.24	.32	-.08
Standing long jump	.11	.21*	.03	.03	.11	-.02	.32*	.06	.22*	.05	.34*	.05	.18*	.06	.45*	.40*	-.14
Handgrip strength	.00	-.04	.13	-.06	-.10	.19*	.43*	-.09	-.19	-.04	-.03	-.04	-.06	.08	.17	-.08	.10
PA week	1.00	.29*	.14*	1.00	.22*	.07	.09	1.00	.28*	.18	.15	1.00	.19*	.10	1.00	.68*	.00
PA weekend	.29*	1.00	.14*	.22*	1.00	.19*	.07	.28*	1.00	.04	-.05	.19*	1.00	.08	.68*	1.00	-.14
TV week	-.22*	-.11	-.03	-.28*	-.13	.01	.04	-.14	-.07	-.07	-.23*	-.17*	-.05	.05	-.43*	-.39*	-.04
TV weekend	-.04	-.11	-.05	.01	-.08	.01	.08	-.13	-.20	-.13	-.07	.06	-.02	.00	-.41*	-.43*	-.10

Fat % BP = Body fat percentage (BOD POD), Sit-and-reach-R = Sit-and-reach with right leg, Sit-and-reach-L = Sit-and-reach with left leg, St long jump =

Standing long jump, \* = significance ( $p \leq 0.05$ ), BMI = Body Mass Index, W = PA week, WE = PA weekend, Dist = Distance

In Table 5 the distance boys walked to school had a significantly positive relation to hand grip strength ( $r = 0.19^*$ ), flexibility ( $r = 0.21^*$ ) and PA during the weekend ( $r = 0.19^*$ ). In the group, the distance walked to school showed low but significant relationships with PA during the week ( $r = 0.14^*$ ) and weekends ( $r = 0.14^*$ ). Body fat, push ups, standing long jump and television viewing during the week all showed significant relationships with week and weekend PA levels. Boys' pull-ups and girls' flexed arm values also correlated significantly with most of the PA and PF variables, from which the conclusion can be drawn that strength is related to other PF variables such as aerobic fitness and flexibility.

Table 5 further indicates relationships (although small) between the time and distance that learners walked to school and PA and PF. A tendency of a relationship between PA, body composition and PF is evident. The biggest relationship appeared in School 2, between distance walked and percentage fat ( $r = 0.41$ ). Time spent walking and curl-ups ( $r = 0.37$ ) and sit-and- reach ( $r = 0.36$ ) also correlated positively, which indicates a relationship between abdominal muscle strength, hamstring flexibility and walking distance.

## **Discussion**

The results of this study regarding the physical fitness status of this group of learners from a previously disadvantaged community showed that their physical fitness status, including aerobic fitness, flexibility and body composition was of such a nature that they would derive health benefits from it. The reasonably high fat percentage in the group, was however a concern. Strength (in all the different areas of the body that had been assessed) was, however, not sufficient to provide health benefits. It is therefore imperative that attention should be given to that aspect of their physical fitness make-up when physical fitness activity intervention programmes are planned.

With regard to the learners' PA levels, moderate PA levels were found among the boys and girls from School 1 and the boys from School 2. Physical activity guidelines for adolescents required moderate activity for at least 30 minutes per day (Jackson *et al.*, 1999; Sharkey, 2002; Hamlin & Ross, 2005), which was reached in the majority of the group, and which could be considered sufficient from which to obtain health benefits. Only the girls in School 2 were categorised into the low PA category, indicating that they were at risk with regard to possible health problems. However, the learners in our study were more physically active compared to findings of other researchers regarding the physical activity levels of learners of the same age

group (Zakarian *et al.*, 1994; Fox *et al.*, 2004). The results of Kriska (2000) and Prinsloo and Pienaar (2005) are, however, in agreement with this study, indicating higher physical activity levels among children living in poor socio-economic circumstances. Although classified as reasonably active, very high percentages of TV watching were found in this group of learners, especially during weekends (up to three and a half hours). Similar tendencies of high TV viewing times among children from disadvantaged communities were also reported by Coe *et al.* (2006). From a health perspective, this sedentary choice of activity was a reason for concern about these learners. Pate *et al.* (1997) indicated that children who watched more than three hours television per day were significantly less active than children who spent less time watching television, while Hamlin and Ross (2005) found a relationship between watching television during the childhood years and adolescence and obesity, poor cardio-respiratory fitness, raised serum cholesterol and cigarette smoking in early adulthood. Such a relationship was especially confirmed in this research among the girls from School 2, between TV viewing and week and weekend PA levels.

A significant but low relationship was also established between the distance all the participants of this study walked to school and higher PA levels during the week and weekends. Tudor-Locke *et al.* (2001) and Hamlin and Ross (2005) also reported that children who walked to school were more physically active, especially boys. Thus, the deduction can be made that there is a relationship between the distance that learners walk to school, body composition, abdominal muscle strength, hamstring flexibility, PF and PA. In the study by Chan *et al.* (2003), they also found that PA significantly correlated with cardiovascular capacity, muscle strength and body composition in adolescents in Hong Kong. Our study showed that the same tendency occurred, and relationships with leg strength and flexibility were additionally seen among the boys, and with percentage body fat among the girls in School 2. A relationship was found in this regard between the strength variables in boys (pull-ups) and girls (flexed arm hang) and aerobic fitness, flexibility, push-ups and standing long jump and these variables also had an influence on one another.

In conclusion, the results of this study indicate that the PF of the learners from School 1 is better than that of School 2 and that they are more active and watch less television than learners from School 2. It is further concluded that week and weekend PA and percentage body fat were influenced by aspects such as distances walked, and television watching also played a role in PA levels and strength of girls. It therefore seems important to sustain and

encourage activities such as walking to school. It should, however, be remembered that these adolescents are part of a process of westernisation. Thus, when they no longer have the advantages of walking to school, which they are now obliged to do, they could become an at-risk group with regard to health problems. High percentages of TV viewing during the week and especially weekends also indicate the possibility of few other activity possibilities for these learners. It is therefore important to empower adolescents living in disadvantaged communities with knowledge and skills to enable them to maintain and increase their PA levels.

A limitation of the study was that information regarding after-school sports participation (sports club related) was not collected and could therefore not be taken into account in evaluating the physical activity levels and patterns of the group. It is therefore recommended that future studies take this into account.

### **Acknowledgement**

Our sincere gratitude to the National Research Foundation (NRF) for the financial grant received for completing the research, and to all the role players in the multi-disciplinary PLAY research project for their contributions.

## REFERENCES

- BARANOWSKI, T.; MENDLEIN, J.; RESNICOW, K.; FRANK, E.; CULLEN, K. & BARANOWSKI, J. (2000). Physical activity and nutrition in children and youth: an overview of obesity prevention. *Preventive Medicine*, 31:S1-S10.
- BOD POD – Customer training. (2003). Body composition tracking system. Life Measurement, Inc.
- CHAN, E.W.C.; AU, E.Y.M.; CHAN, B.H.T.; KWAN, M.K.M.; YIU, P.Y.P. & YEUNG, E.W. (2003). Relations among physical activity, physical fitness, and self-perceived fitness in Hong Kong adolescents. *Perceptual and Motor Skills*, 96:787-797.
- COE, D.P.; PIVARNIK, J.M.; WOMCK, C.J.; REEVES, M.J. & MALINA, R.M. (2006). Effect of physical education and activity levels on academic achievement in children. *Medicine & Science in Sport & Exercise*, 38,1515-1519.
- COOPER, A.R.; PAGE, A.S.; FOSTER, L.J. & QAHWAJI, D. (2003). Commuting to school: are children who walk more physically active? *American Journal of Preventive Medicine*, 25(4):273-276.
- DOCHERTY, D. (1996). Measurement in Pediatric Exercise Science. Canada : Human Kinetics.
- ENGELBRECHT, C. (2001). Die verband tussen fisieke aktiwiteit en fisieke fiksheid van 13- tot 15-jarige dogters in die Noordwes-provinsie. Ongepubliseerde verhandeling, PU vir CHO, Potchefstroom, Suid Afrika.
- FOX, K.R.; COOPER, A. & MCKENNA, J. (2004). The school and promotion of children's health-enhancing physical activity: Perspectives from the United Kingdom. *Journal of Teaching in Physical Education*, 33, 338-358.
- HALL, P.A. & FONG, G.T. (2003). The effects of a brief time perspective intervention for increasing physical activity among young adults. *Psychology and Health*, 18(6):685-706. December.
- HAMLIN, M.J. & ROSS, J.J. (2005). Barriers to physical activity in young New Zealanders. *Youth Studies Australia*, 24(1):31-37.
- HUMAN ENERGY REQUIREMENTS. (2001). Report of joint FAO/WHO/UNU expert consultation, Rome 17-24 October 2001.
- JACKSON, A.W.; MORROW, J.R.; HILL, D.W. & DISHMAN, R.K. (1999). Physical activity for health and fitness: an individualised lifetime approach. Hong Kong: Human Kinetics. 366 p.

- KEMPER, H.C.G.; TWISK, J.W.R.; KOPPEL, L.L.J.; VAN MECHELEN, W. & POST, G.B. (2001). A 15-year physical activity pattern is positively related to aerobic fitness in young males and females (13-27 years). *European Journal of Applied Physiology*, 84:395-402.
- KRISKA, A. (2000). Ethnic and cultural issues in assessing physical activity. *Research Quarterly for Exercise and Sport*, 71(2):47-53.
- LESLIE, E.; FOTHERINGHAM, K.J.; OWEN, N. & BAUMAN, A. (2001). Age-related differences in physical activity levels of young adults. *Medicine & Science in Sport & Exercise*, 33(2):255-258.
- MEREDITH, M.D & WELK, G.J. (1999). Fitnessgram: Test administration manual. 2<sup>nd</sup> ed. Dallas : Human Kinetics.
- NEUMARK-SZTAINER, D.; STORY, M.; HANNAN, P.J.; THARP, T. & REX, J. (2003). Factors associated with changes in physical activity: a cohort study of inactive adolescent girls. *Archives of Pediatrics & Adolescent Medicine*, 157:803-810. Aug.
- PATE, R.R.; TROST, S.G.; DOWDA, M.; OTT, A.E.; WARD, D.S.; SAUNDERS, R. & FELTON, G. (1999). Tracking of physical activity, physical inactivity and health-related physical fitness in rural youth. *Pediatric Exercise Science*, 11:364-376.
- PATE, R.R.; TROST, S.G.; FELTON, G.M.; WARD, D.S.; DOWDA, M. & SAUNDERS, R. (1997). Correlates of physical activity behaviour in rural youth. *Research Quarterly for Exercise and Sport*, 68(3):241-248.
- PRINSLOO, A. & PIENAAR, A.E. (2005). Fisieke fiksheid, fisieke aktiwiteit en fisieke aktiwiteitspatrone van plaaswerkerkinders: FLAGH-studie. *Suid-Afrikaanse Tydskrif vir Navorsing in Sport, Liggaamlike Opvoedkunde en Ontspanning*, 27(1):117-131.
- SHARKEY, B.J. (2002). *Fitness & Health* (5<sup>th</sup> ed.). Hong Kong : Human Kinetics.
- STATSOFT. (2004). *Statistica for Windows*. Release 5.5: general conversions and statistics. Tulsa, Oklahoma : StatSoft.
- TROST, S.G., WARD, D.S., MCGRAW, B. & PATE, R.R. (1999). Validity of the previous day physical activity recall in fifth-grade children. *Pediatric exercise science*, 11:341-348.
- TUDOR-LOCKE, C.; AINSWORTH, B.E. & POPKIN, B.M. (2001). Active commuting to school: an overlooked source of childrens' physical activity? *Sports Medicine*, 1(5):309-313.
- WOOD, R. (1997). Fitness testing. [Web:] [http://fitness\\_testing.8m.com/anaerob.htm](http://fitness_testing.8m.com/anaerob.htm). [Date accessed: 4 March 2002].

ZAKARIAN, J.M.; HOVELL, M.F.; HOFSTETTER, R.; SALLIS, J.F. & KEATING, K.J. (1994).  
Correlates of vigorous exercise in a predominantly low SES and minority high school  
population. *Preventive Medicine*, 23:314-321.

# CHAPTER 4

**Barriers, motivators, sport participation and perceptions of physical activity among adolescents living in semi-urban surroundings**



Running head: BARRIERS, MOTIVATORS FOR PHYSICAL ACTIVITY

Barriers, motivators, sport participation and perceptions of physical activity among adolescents  
living in semi-urban surroundings

Anita Lennox (M.A.), Anita E. Pienaar (Ph.D) and Mercia Coetzee (Ph.D)

School of Biokinetics, Recreation and Sport Science, North-West University, Potchefstroom  
Campus

Corresponding author:

Prof. Anita E. Pienaar

North-West University (Potchefstroom Campus)

School of Biokinetics, Recreation and Sport Science

Private Bag X6001

Potchefstroom 2531

South Africa

Prof. Anita E. Pienaar

Telephone: (+27) 018 299 1796

Fax: (+27) 018 299 1796

Email: [Anita.Pienaar@nwu.ac.za](mailto:Anita.Pienaar@nwu.ac.za)

Me. Anita Lennox

Telephone: 082 340 8466

E-mail: [anitalennox@absamail.co.za](mailto:anitalennox@absamail.co.za)

## Abstract

This study aimed to determine what factors would be seen as barriers to sport participation and motivators for adolescents of low socio-economic status (SES) for improving their physical activity (PA) and participation in sport and determining their perceptions of their own PA level. Two schools were involved in the testing, School 1 (252 learners, 116 boys and 136 girls) and School 2 (66 learners, 21 boys and 45 girls). A questionnaire from Rowland (1990) was used, with some additional questions from Meredith and Welk (1999) as well as demographic questions to determine the learners' mode of travel to and from school as most learners walked to school. Most of the learners participated in sports which were mostly soccer and netball. Frequency and rank ordering analyses indicated that the barriers they experienced for not being physically active were: too much homework, lack of money, home and family responsibilities, lack of facilities and coaches, watching television (TV) and time constraints. Factors that would motivate learners to participate in PA were having parents that encouraged them, friends that participated with them and reminders of the health advantages of PA. The results showed that after participation in a PA programme the learners' perceptions of PA intensity changed and they had a better knowledge of the intensity of PA. The results of this study is helpful in understanding the barriers and motivators of PA among adolescents living in low socio-economic environments in order to increase their PA and participation in sports.

**Keywords:** Adolescents, sport participation, physical activity, barriers, motivators

## Barriers, motivators, sport participation and perceptions of physical activity among adolescents living in semi-urban surroundings

### Introduction

Regular participation in physical fitness (PF) and physical activity (PA) are important to sustaining good health as well as preventing obesity and illness (Shropshire & Carrol, 1998; Pate, Trost, Dowda, Ott, Ward, Saunders & Felton, 1999; Sharkey, 2002). Low levels of physical activity and physical fitness are associated with several cardiovascular risk factors, whilst regular exercise can lead to enhanced levels of psychological wellness and the development of a positive self-image (Marshall, Sarkin, Sallis & McKenzie, 1998; Hall & Fong, 2003). Research indicates that PA levels of girls decrease with age, to a greater extent than with boys (Neumark-Sztainer, Story, Hannan, Tharp, Rex, 2003; Hamlin & Ross, 2005).

Researchers show that perceptions of PA and PF differ according to knowledge and exposure to PA and PF (Flohr & Williams, 1997; Placek, Griffin, Dodds, Raymond, Tremino, James, 2001). Placek *et al.* (2001) found misperceptions among urban adolescents, where thinness was identified as an indication of fitness, whilst weight loss was regarded as being synonymous with PF and an advantage for participating in PA. This group of adolescents demonstrated no knowledge of the exercise components and the health advantages of exercise. It was also found that a positive attitude towards participation in PA or sport appeared to be an important factor for sustained participation in sport. The research of Prochaska, Sallis, Slymen, McKenzie (2003) showed that a positive attitude towards physical activity could lead to increased participation in school sports and extra-mural physical activity, while Prusak, Treasure, Darst and Pangrazi (2004) indicated that girls who were intrinsically motivated participate in sport for a longer duration than girls who were extrinsically motivated.

Research studies also explore reasons why adolescents experience barriers which prevent them from being physically active. Children from rural communities, for example, are not regular participants of sports activities due to lack of access to (or sheer lack of) sports facilities, family responsibilities, lack of information, a poor perception of own talent or skills, and limited time available to them (Coetzee, 2003). Lack of time, distance from sports facilities, cost of supervised programmes, limited facilities and poor community security were indicated by Nahas, Goldfine and Collins (2003) and Sallis, Zakarian, Hovell and Hofstetter

(1996) as being additional obstacles to participation in sport. Saxena, Borzekowski and Rickert (2002) found that 56% of adolescent girls did not participate in physical activity as a result of a lack of time, whilst the study also indicated that 44% were too lazy to be physically active, 15% did not have a place to exercise, 10% regarded it as boring, 6% experienced pain, 7% did not know how to, and 5% did not like to sweat. Deflandre, Antonini and Lorant (2004) found that children of average socio-economic status (SES) felt that they had other things to do with their time and regarded themselves as being too overloaded with school work to be physically active.

The purpose of this study was to determine the pattern of sport participation of adolescent learners from a low socio-economic environment, as well as factors which would hinder their participation in PA and factors which would motivate them to be physically active. It also investigated whether girls and boys experienced the same barriers and motivations with regard to participation in PA. Thirdly, this study determined the adolescents' perceptions of their own participation in physical activity and whether or not those perceptions were altered after participation in a physical activity programme.

## Method

### Research design

A two-group pre-test and post-test research design was used. Two closely-situated high schools in Ikageng, a semi-urban area in the Potchefstroom area in the North-West Province, were identified as part of the multi-disciplinary PLAY study (*Physical Activity in Youth*) for the purpose of this study. All the scholars in Grade 8 (School 1) were approached to participate in the experimental group in the study. The scholars from School 2 (Grade 8) served as the control group. Only scholars, whose parents had given informed consent for them to participate, were included in the study. The study protocol was approved by the Ethics Committee of North–West University (04M01) in Potchefstroom.

### Experimental sample

The experimental group consisted of 252 Grade 8 learners (116 boys and 136 girls) from School 1. The control group consisted of the 66 Grade 8 learners from School 2 (19 boys and 47 girls). Parents in both schools granted informed consent for the adolescents to participate in the study. The study consisted of a pre- and a post-test, and fewer learners from both schools were involved in the second test. Complete data was obtained from 216 learners in

School 1 (92 boys and 124 girls) and 62 learners in School 2 (19 boys and 43 girls), which could be analysed. The average age of the included School 1 learners was 14.8 years ( $\pm 1.43$ ) and for School 2 it was 13.9 years ( $\pm 1.04$ ). All the learners in the study live in low income communities in areas surrounding the schools. In these areas there are very few facilities available to participate in physical activities, especially in sport, although youngsters can participate in sport at the community sport stadium, situated about 4 km from the school.

### Physical activity programme

The intervention programme was conducted twice a week for 60 minutes per session directly after school hours. Because of practical reasons the programme could only be done twice a week. The reasons being it was after school hours and most of these learners (96.43% of the experimental group and 92.42% of the control group) walked to school for thirty minutes or more each school day and could be seen as an activity session, thus the learners exercised for 3 days and more. Literature indicates that children should be physically active on all or most of the days for 30-60 minutes per session, according to this the 60 minute duration of the programme was divided into 30 minutes of aerobic training, 15 minutes of strength and flexibility training and 15 minutes of ball skills related exercises. Aerobic training was done because it was the best way to get the learners moderate to highly active and it form part of the health related physical fitness components with strength and flexibility. Ball skills training were done to improve ball skills. The sessions started with all the children doing aerobic training, after which the children were divided into two smaller groups where they participated in strength and flexibility training and ball skills sessions. The aerobic training included dancing, Kata boxing, and aerobic exercises. Although the children were motivated to participate in the programme their participation was voluntary, as the programme had to be done directly after school hours. Trained post graduate students in human movement science assisted with the programme and children who were divided into smaller groups according to their school classes. They also kept the attendance register.

### Measuring instruments

#### Questionnaire on barriers to participation

The questionnaire of Rowland (1990) which deals with barriers to physical activity and participation in sport was used in this study. A few of the questions were adjusted and additional questions from Meredith and Welk (1999) were added. Demographic questions were also added on how far learners walked to school and how long it took them. Most

questions were based on a yes or no answer, and then an open question explaining the previous answer.

The first part of the questionnaire gathered demographic information about how the learners travelled to school and in which sports and activities they participated. The first section of the questionnaire dealt with the learners' physical activity levels. Questions included aspects such as whether they were, in terms of established PA guidelines, as active as they should be and whether they performed exercise which got them to perspire and feel out of breath. Learners were also asked what prevented them from being more physically active and what would motivate them to be more physically active.

#### Data processing

The data was processed by means of the Statistica for Windows (StatSoft Inc. SA, 2004) programme. The results were mainly analysed in a descriptive manner by means of percentages, rank ordering and frequencies.

#### Results

From Figure 1, displaying the types of transport used by the learners, it can be seen that nearly all the learners from both the experimental group (96.43%) and the control group (92.42%) walked to school and that the average time it took ranges from 15 to 45 minutes. The average distance that they covered during this time is 3 to 5 kilometres (or six to ten kilometres per day to school and back).

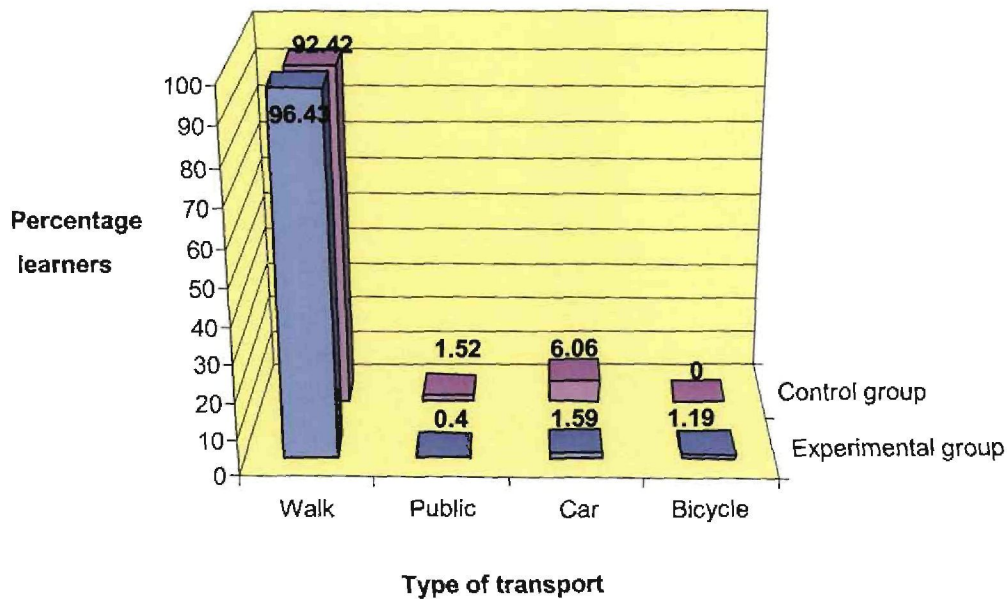


Figure 1: Percentage learners using different types of transport to attend school

Table 1 indicates learners' involvement in organised sport during the last six months. From this it can be deduced that the majority of learners in both groups participated in sport (82.94 and 78.79%) during March. Soccer and netball were, by far, the most popular sports in which most took part, whilst basketball, cricket and volleyball were also popular. According to the results of the post-test (in September) sports participation in both groups had decreased (experimental group from 82.94% to 70.37%, control group from 78.79% to 67.74%). A possible explanation can be that the sports are seasonal. Participation decreased in both boys (87.93% to 66.38%) and girls (78.68% to 55.15) in the experimental group. In the control group the girls' participation also dropped from 72.34% to 51.06%, whilst the boys' participation did not change. The results indicate that a greater percentage of boys than girls participated in sport in both groups.

Table 1: Learners' involvement in organised sport or exercise during the last 6 months

	Experimental group				Control group			
	Pre-test		Post-test		Pre-test		Post-test	
Total group	N	%	N	%	N	%	N	%
Participants	209	82.94	152	70.37	52	78.79	42	67.74
Non-participants	43	17.06	64	29.63	14	21.21	20	32.26
<b>Boys</b>								
Participants	102	87.93	77	66.38	18	94.74	18	94.74
Non-participants	14	12.07	15	12.93	1	5.26	1	5.26
<b>Girls</b>								
Participants	107	78.68	75	55.15	34	72.34	24	51.06
Non-participants	29	21.32	49	36.03	13	27.66	19	40.43
<b>Sports codes</b>								
Netball	65	25.79	54	25.00	17	25.76	9	14.52
Soccer	101	40.08	72	33.33	16	24.24	15	24.19
Basketball	8	3.17	11	5.09	6	9.09	4	6.45
Running	1	0.40	0	0	0	0	0	0
Volleyball	4	1.59	0	0	2	3.03	1	1.61
Dancing	4	1.59	2	0.93	0	0	3	4.84
Javelin	2	0.79	0	0	0	0	0	0
Cricket	11	4.37	3	1.39	6	9.09	4	6.45
Athletics	1	0.40	0	0	0	0	0	0
Softball	37	2.78	10	4.63	2	3.03	2	3.23
Drum majorettes	1	0.40	1	0.46	1	1.52	2	3.23
Gymnastics	5	2.00	0	0	1	1.52	1	1.61
Karate	1	0.40	0	0	0	0	1	1.61
Tennis	1	0.40	0	0	0	0	1	1.61
Rugby	1	0.40	1	0.46	0	0	0	0
Golf	0	0	0	0	1	1.52	0	0
Weight-lifting	0	0	0	0	1	1.52	0	0

\*= Significant differences= $p < 0.05$

Information was also sought on the learners' perceptions of their PA status over the last three months of which the results are reported in Table 2. The different options which describe the current level of physical activity were explained to each learner and the results are reported in Table 2. It was described as follows: inactive (watch TV, read, do homework after school, gets transported to school, and no sport activities after school); sporadically active (prefers sedentary activity – mostly in resting position - but sometimes plays outside); moderately active (uses opportunities to be involved in physical activity, if available, and enjoys it); active (takes initiative to participate in PA and prefers it to sedentary activity, involved in high intensity activity at least three times per week); very active (participates regularly in sport after school, high energy user, does not like sedentary activities). After initially completing the questionnaire, the learners from the experimental group took part in a physical activity programme, the purpose being to determine whether participation in such a programme had altered their perceptions of their PA levels.

The majority of learners in the experimental group regarded themselves as active (37.70%) and highly active (36.90%) before participating in the intervention programme (Table 2). Table 1 substantiates that this is the case (82.94%), upon analysis of their participation patterns. In the post-test, after exposure to the PA programme, this percentage changed considerably (as only 1.39% still indicated that they were highly active) (Table 2). Table 1 indicates a decrease in participation in sport to 70.37%, which to some extent supports the results. The majority of the group had classified themselves in the active category (94.91%). A possible explanation could be that by participating in the programme, learners discovered what active and regular participation implied and that the description of that category had become clearer to them. Another possible explanation could also be that their sport patterns had changed, as is seen in Table 1, which made them less active. There was a shift from highly active (51.72%) to active (75.86%) in boys in the experimental group while the girls' percentage of active changed from 42.65% before the programme to 86.03% after participating in the programme (table 2). A greater percentage of the girls indicated that they were only active after the programme. The percentage of boys in the control group (100% to 78.95%) and girls (78.72% to 51.06%) indicates a drop in the number of learners who regarded themselves as active (Table 2). The greater change in the perception of PA in learners in the experimental group compared with those in the control group confirms the assumption that a better perception of what it is to be physically active contributed to this significant decrease (Table 2).

Table 2: Learners' perception of their PA status during the last 3 months

	Experimental group				Control group			
	Pre-test		Post-test		Pre-test		Post-test	
	N	%	N	%	N	%	N	%
Inactive	11	4.37	6	2.78	5	7.58	19	30.65
Sporadically active	2	0.79	0	0	0	0	0	0
Moderately active	51	20.24	2	0.93	5	7.58	2	3.23
Active	95	37.70	205	94.91	56	84.85	39	62.90
Highly active	93	36.90	3	1.39	0	0	2	3.23
<b>Boys</b>								
Inactive	0	0	3	2.59	0	0	1	5.26
Sporadically active	0	0	0	0	0	0	0	0
Moderately active	19	16.38	0	0	0	0	2	10.53
Active	37	31.90	88	75.86	19	100.00	15	78.95
Highly active	60	51.72	1	.86	0	0	1	5.26
<b>Girls</b>								
Inactive	11	8.09	3	2.21	5	10.64	18	38.30
Sporadically active	2	1.47	0	0	0	0	0	0
Moderately active	32	23.53	2	1.47	5	10.64	0	0
Active	58	42.65	117	86.03	37	78.72	24	51.06
Highly active	33	24.26	2	1.47	0	0	1	2.13

N = Number of learners

Next it was established whether the learners participated in high intensity activity (participation in activities of at least an hour per session which made them breathless and sweat). A "yes" answer indicated that they were active according to the description while more active and not active enough were the next part of this question that they could choose from (Table 3).

Table 3: Participation in activity for at least an hour, sufficient to let you feel out of breath and sweating

	Experimental group				Control group			
	Pre-test		Post-test		Pre-test		Post-test	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Yes	191	75.79	138	63.89	48	72.73	38	61.29
More active	28	11.11	28	12.96	11	16.67	5	8.06
Not active enough	33	13.10	50	23.15	7	10.61	19	30.65
<b>Boys</b>								
Yes	94	81.03	56	48.28	13	68.42	15	78.95
More active	14	12.07	15	12.93	5	26.32	3	15.79
Not active enough	8	6.90	21	18.10	1	5.26	1	5.26
<b>Girls</b>								
Yes	97	71.32	82	60.29	35	74.47	23	48.94
More active	14	10.29	13	9.56	6	12.77	2	4.26
Not active enough	25	18.38	29	21.32	6	12.77	18	38.30

*N* = Number of learners

Table 3 reveals that the majority of learners participated in high intensity activities for at least an hour per day, but after exposure to a PA programme, the learners' perception of the intensity of exercise changed and they then indicated that they were not as active as before they had participated in the programme. There was a reduction in the percentage of learners who indicated that they were active enough, among both boys (81.03% to 48.28%) and girls (71.32% to 60.29%) in the experimental group and the girls (74.47% to 48.94%) in the control group. The boys in the control group indicated an increase, in participation of activity of at least an hour a day that left you breathless, from 68.42% to 78.95%. The results correlate with the results of Tables 1 and 2. According to their own judgement, two-thirds meet the criteria for sufficient participation in health-promoting physical activity.

With these perceptions of their PA status as a background, it was further attempted to determine what factors the learners regarded as barriers to being physically active or participating in sport, as well as possible motivators to improve their activity status.

From Table 4 it appears that homework, lack of money, home and family duties, lack of sports facilities/coaches and too little time are the five main barriers that discourage participation in sport and physical activities of the total group. Learners from the control group regarded watching television as a far greater barrier than learners from the experimental group (rank order 3 compared to 7 in the experimental group), while the learners from the experimental group regarded illness/poor health and tiredness as a greater barrier than learners from the control group. The lowest ranking was given to factors such as lack of interest in sport, indicating that learners still want to be active and these results confirm the findings in Table 1-3.

These barriers were also analysed according to gender. According to Table 5 the boys in both schools indicated that the biggest barriers were lack of money, sports facilities and coaches. The girls of both groups indicated school homework as their biggest barrier. The girls in the control group named watching TV as the second biggest barrier, whilst lack of money was the second biggest barrier for the girls in the experimental group. Both boys and girls in the control group regarded watching television as a greater barrier than boys and girls in the experimental group.

Table 4: Rank ordering of factors which emerged as barriers to participating in physical activity

	Group			Experimental group			Control group		
	RO	M	SD	RO	M	SD	RO	M	SD
Homework takes up too much time	1	.310	.463	1	.306	.462	2	.333	.475
Lack of funds	2	.298	.458	2	.278	.449	1	.379	.489
Home/family duties	3	.216	.412	4	.214	.411	4	.227	.422
Lack of sport facilities/coaches	4	.216	.412	3	.222	.417	6	.197	.401
Not enough time	5	.147	.355	5	.163	.370	9	.091	.290
Watch TV	6	.138	.345	7	.087	.283	3	.333	.475
Illness/poor health/ tiredness	7	.094	.292	6	.095	.294	10	.091	.290
Scared of injury	8	.063	.243	8	.044	.205	5	.136	.346
Transport problems	9	.053	.225	9	.040	.196	7	.106	.310
Lack of information	10	.047	.212	12	.032	.176	8	.106	.310
Lack of enjoyment	11	.031	.175	11	.032	.176	12	.030	.173
No friends who play sport together	12	.031	.175	10	.036	.186	14	.015	.123
Not interested	13	.019	.136	13	.016	.125	11	.030	.173
Don't feel talented	14	.016	.124	14	.016	.125	13	.015	.123
Feel guilty	15	.003	.056	15	.004	.063	15	.000	.000

RO = Ranking, M = mean, SD = Standard deviation

Table 5: Rank ordering of factors which boys and girls from both groups regarded as barriers to participating in physical activity

Factors	Experimental group						Control group					
	Boys (n=92)			Girls (n=124)			Boys (n=22)			Girls (n=40)		
	RO	N	%	RO	N	%	RO	N	%	RO	N	%
Lack of funds	1	29	25.0	2	41	30.1	1	8	42.1	3	17	36.2
Lack of sports facilities/ coaches	2	28	24.1	4	28	20.6	2	7	36.8	7	6	12.8
Homework	3	22	18.9	1	55	40.4	4	4	21.1	1	18	38.3
Home/family duties	4	21	18.1	3	33	24.3	5	3	15.8	4	12	25.5
Not enough time	5	17	14.7	5	24	17.6	13	-	-	6	6	12.8
Watching TV	6	10	8.6	7	12	8.8	3	5	26.3	2	17	36.2
Illness/poor health/tiredness	7	9	7.8	6	15	11.0	7	2	10.5	9	4	8.5
Do not enjoy playing sport	8	4	3.4	12	4	2.9	10	1	5.3	12	1	2.1
Transport problems	9	4	3.4	10	6	4.4	6	3	15.8	10	4	8.5
Not enough friends who play sport together	10	3	2.6	9	6	4.4	14	-	-	13	1	2.1
Scared of injury	11	3	2.6	8	8	5.9	8	2	10.5	5	7	14.9
Lack of information	12	3	2.6	11	5	3.7	12	1	5.3	8	6	12.8
Do not feel talented	13	2	1.7	14	2	1.5	11	1	5.3	14	-	-
Not interested	14	1	0.9	13	3	2.2	9	1	5.3	11	1	2.1
Feel guilty	15	-	-	15	1	0.7	15	-	-	15	-	-

N = Number of learners, RO = Rank order, % = Percentage

Table 6: Reasons that would motivate adolescent boys and girls to start exercising or to consider exercising

	Boys (n=114)			Girls (n=164)		
	N	%	RO	N	%	RO
A friend to exercise with	116	95.87	3	132	94.29	5
Friends who encourage you to exercise	110	90.91	8	123	87.86	8
Summer clothes that you would like to buy	54	44.63	12	86	61.43	11
Extra-mural, organised activity	114	94.21	6	130	92.86	6
Parent/s who exercise	112	92.56	7	117	83.57	9
Your reflection in the mirror	73	60.33	11	81	57.86	12
Parents who encourage exercise	117	96.69	2	140	100	1
Reminded of the health benefits of PA	118	97.52	1	135	96.43	2
Reading about exercise in magazines	84	69.42	10	114	81.43	10
Physical education classes during school hours	115	95.04	4	134	95.71	3
Pictures of physically healthy persons in magazines and on TV	115	95.04	5	128	91.43	7
Watching exercising on TV	110	90.91	9	133	95.00	4

N= Number of learners, % = Percentage learners, RO = Rank order

Table 6 indicates that similar reasons will motivate boys and girls to exercise or to begin exercising namely: parents who give encouragement and being reminded of the health benefits of exercising. Physical activity classes at school and friends who also exercise are also important for both sexes. The factors which will provide the least motivation are seeing summer clothes you wish to buy and seeing your reflection in the mirror.

The same trend is evident from the results in Table 7, where the most important motivators found to be similar for both boys and girls, namely, to improve one's self-image, to do something active with friends and to raise energy levels. The least important motivators for both sexes are reducing stress and losing weight.

Table 7: Reasons that will encourage adolescents to be physically active

	Boys (n=114)			Girls (n=164)		
	N	%	RO	N	%	RO
To stay fit and healthy	98	80.99	5	105	75	5
To loose weight	19	15.70	12	45	32.14	12
To increase energy levels	115	95.04	3	130	92.86	3
To reduce stress	39	32.23	11	49	35	11
To improve self-image	118	97.52	1	136	97.14	1
To be more physically attractive to others	71	58.68	8	73	52.14	8
To become strong	112	92.56	4	113	80.71	4
To do something active with friends	118	97.52	2	136	97.14	2
For pleasure/fun	70	57.85	9	68	48.57	10
For cardio-respiratory fitness	66	54.55	10	89	63.57	7
To be able to compete	78	64.46	6	91	65	6
To be more acceptable to friends	76	62.81	7	70	50	9

N = Number of learners, % = Percentage learners, RO = Rank order

## Discussion

The purpose of this study was determining the level of the learners' participation in PA, the factors they regarded as barriers to participating in activity, and the factors which would motivate them to be more physically active. Secondly, the study wanted to determine whether participation in a PA programme would have an effect on learners' perceptions of their own PF and PA participation. This was done against the background of the learners being from a poor socio-economic environment and traveling long distances to school and back.

The activity and sport participation patterns of these learners indicated that they were, as a group, reasonably active. The fact that they walked between 6 to 10 kilometres to school and back every school day indicated that they could be regarded as an active group. Cooper, Page, Foster and Qahwaji (2003) found that primary school learners who mainly walked to school were more active than those who travelled to school by car. That agrees with the findings of this study, in view of the fact that, despite walking long distances, a large percentage of learners also participated in sport. It appeared that the learners regularly participated in sport,

although the percentage participation dropped from the pre- to the post-test, which could be attributed to sport being seasonal. The two sports in which the learners mostly engaged were soccer and netball.

The barriers which prevented learners from participating in organised physical activities and sport were also investigated. The barriers which the learners experienced were directly related to the living circumstances of the group. It appeared that too much homework, home and family duties, lack of sport facilities and coaches, lack of funds and too little time were the main factors inhibiting the learners' participation PA and sport. These results were confirmed by other researchers such as Coetzee (2003), as well as with results of children of slightly higher SES (Saxena *et al.*, 2002; Nahas *et al.*, 2003; Deflandre *et al.*, 2004). Boys in both schools listed different barriers than the girls, namely, lack of funds and sports facilities and coaches, compared to homework, lack of funds (experimental group) and watching too much TV (control group), which were identified as barriers by the girls. Homework which took up a lot of time was also identified in a study by Deflandre *et al.* (2004). Nahas *et al.* (2003), in his research on American children found that lack of time was their biggest barrier, but that they spent more than half their leisure time watching television. Television was seen as a bigger barrier by learners from the control group than by the experimental group and by the girls. The experimental group also named tiredness as a barrier, which might be a result of the long distances that they had to walk to and from school.

The most important factors which would encourage both boys and girls to be physically active were encouragement from parents, friends who would exercise with them and being reminded of the health benefits of PA. Pleasure was identified as one of the weakest motivators. Encouragement from parents, named as one of the main motivators, was also found by Tergerson and King (2002). Although speculative in nature a possible explanation could be that parents underrated the importance of PA because they did not have a background of sports participation and therefore did not see its importance, while performing house duties in the afternoon was expected of their children. Follow-up research (in process) to obtain more information about this trend, has already confirmed this suspicion. Learners indicated that they had a number of domestic tasks such as fetching smaller siblings from day care centres and looking after them. They felt that parents were limiting their freedom by making decisions about their time. It therefore seemed that they sought parental approval rather than encouragement.

Prista, Maia and Marques (1997) established that the home environment was one of the major determinants of PA. The importance of physical education classes offered during school time was indicated as important, as the learner would not have any conflict over time which had to be spent on performing domestic duties. The factors which would least motivate the boys and girls in the group were seeing summer clothes that one wanted to buy and seeing one's reflection in a mirror. That was understandable seeing that these learners came from a poor socio-economic environment and that they had more pressing priorities for spending their money. The factors identified in this study differ from Tergerson and King, (2002), who found that the most important factor for adolescents was to have a friend to exercise with and the factor with the least impact was viewing exercising on television.

Other factors which would motivate both boys and girls, to be PA were improving their self-image, doing something active with friends and raising their energy levels. Follow-up questions showed that one of the main reasons why learners did not get involved in the activity programme which had been offered was that they were too tired. It appeared that they were aware that exercise made one feel better and that they had apparently hoped that exercise would raise their energy levels. It was apparent that learners were the least concerned about their appearance seeing that the lowest motivator for both boys and girls was to loose weight. It might be that most of them were thin, undernourished and aware of that fact. Another possible explanation could be that some of these learners were also overweight and that was acceptable in their culture. The improvement of their self-image was important to them and it appeared that they believed that participating in PA would make a difference. Much of the literature confirmed a relationship between PA and an improved self-image (Marshall *et al.*, 1998). The lowest motivator with both boys and girls was to loose weight. These results differ from those of Tergerson and King, (2002), and from Cheng, Cheng, Mak, Wong, Wong and Yeung (2003), who found that, health and body image were important motivating factors. It appeared that the participants in this study regarded different factors which would motivate them to become physically active, as important to those found in other studies. These learners had a different background and possibly did not have the same facilities that other learners in other research studies had.

From this study it appeared that, after exposure to the exercise programme, the learners' (experimental group) knowledge and experience of the intensity of PA participation was

broadened, and that to some extent it did result in a change of perception. Prior to the programme, the great majority of learners perceived themselves as being more active than after exposure to the programme. It can be concluded that due to the participation in the programme the learners were exposed to what exercise involved and what it meant to be active.

The information gathered by this study is important because it has brought some perspective on the PA and sports participation of adolescents who have a low SES and live in an environment with few facilities for participating in sport. Information gathered about the barriers and motivators they experienced can be used as guidelines to address their problems if their PA is to be raised. PA and participation in sport can make a difference in the lives of these adolescents therefore it is important to make them more aware of the advantages of exercise. A recommendation emerging from this study is that parents of children and adolescents living in low socio-economic environment should be informed about the benefits of regular exercise, because participation in sport and the parents' approval and encouragement were found to be important barriers preventing these youngsters from being active.

### **Acknowledgement**

Our sincere thanks to the National Research Foundation (NRF) for the financial grant received to complete this research. Thank you also to the PLAY research team that helped with the research and in particular for Prof. S. Kruger for her contribution.

## REFERENCES

- Cheng, K.Y., Cheng, P.G., Mak, K.T., Wong, S.H., Wong, Y.K. & Yeung, E.W. (2003). Relationship of perceived benefits and barriers to physical activity, physical activity participation and physical fitness in Hong Kong female adolescents. *The Journal of Sports Medicine and Physical Fitness*, 43(4), 523-529.
- Coetzee, Z. (2003). Redes en hindernisse vir sportdeelname by hoërskoolleerlinge in die Potchefstroom-distrik. (Ongepubliseerde Verhandeling – M.Sc.) Potchefstroom : PU vir CHO. (Reasons and barriers to sport participation among high school learners in the Potchefstroom district. (Unpublished Thesis – MA). Potchefstroom: PU for CHE.
- Cooper, A.R., Page, A.S., Foster, L.J. & Qahwaji, D. (2003). Commuting to school: are children who walk more physically active? *American Journal of Preventive Medicine*, 25(4), 273-276.
- Deflandre, A., Antonini, P.R. & Lorant, J. (2004). Perceived benefits and barriers to physical activity among children, adolescents and adults. *International Journal of Sport Psychology*, 35, 23-36.
- Flohr, J.A. & Williams, J.A. (1997). Rural fourth graders' perceptions of physical fitness and fitness testing. *Physical Educator*, 54(2), 78-88.
- Hall, P.A. & Fong, G.T. (2003). The effects of a brief time perspective intervention for increasing physical activity among young adults. *Psychology and Health*, 18(6), 685-706.
- Hamlin, M.J. & Ross, J.J. (2005). Barriers to physical activity in young New Zealanders. *Youth Studies Australia*, 24(1), 31-37.

Marshall, S.J., Sarkin, J.A., Sallis, J.F. & McKenzie, T.L. (1998). Tracking of health-related fitness components in youth ages 9 to 12. *Medicine and Science in Sports and Exercise*, 30(6), 910-916.

Meredith, M.D. & Welk, G.J. (1999). *Fitnessgram: Test administration manual*. (2<sup>nd</sup> ed.) Dallas : Human Kinetics Publisher, Inc.

Nahas, M.V., Goldfine, B. & Collins, M.A. (2003). Determinants of physical activity in adolescents and youth adults: the basis for high school and college physical education to promote active lifestyles. *Physical Educator*, 60(1), 42-56.

Neumark-Sztainer D., Story, M., Hannan, P.J., Tharp, T. & Rex, J. (2003). Factors associated with changes in physical activity: a cohort study of inactive adolescent girls. *Archives of Pediatrics & Adolescent Medicine*, 157, 803-810.

Pate, R.R., Trost, S.G., Dowda, M., Ott, A.E., Ward, D.S., Saunders, R. & Felton, G. (1999). Tracking of physical activity, physical inactivity and health-related physical fitness in rural youth. *Pediatric Exercise Science*, 11, 364-376.

Placek, J.H., Griffin, L.L., Dodds, P., Raymond, C., Tremino, F. & James, A. (2001). Chapter 3: Middle school students' conceptions of fitness: the long road to a healthy lifestyle. *Journal of Teaching in Physical Education*, 20, 314-323.

Prista, A., Maia J.A.R. & Marques A.T. (1997). The relationship between physical activity, socio-economic status and physical fitness of 8-15-year-old youth from Mozambique. *American Journal of Human Biology*, 9, 449-457.

Prochaska, J.J., Sallis, J.F., Slymen, D.J. & McKenzie, T.L. (2003). A longitudinal study of children's enjoyment of physical education. *Pediatric Exercise Science*, 15, 170-178.

Prusak, K.A., Treasure, D.C., Darst, P.W. & Pangrazi, R.P. (2004). The effects of choice on the motivation of adolescent girls in physical education. *Journal of Teaching in Physical Education*, 23, 19-29.

Rowland, T.W. (1990). *Exercise and Children's Health*. Ill, USA: Human Kinetics Publisher, Inc.

Sallis, J.F., Zakarian, J.M., Hovell, M.F. & Hofstetter, C.R. (1996). Ethnic, socio economic, and sex differences in physical activity among adolescents. *Journal of Clinical Epidemiology*, 49(2), 125-134.

Saxena, R., Borzekowski, D.L.G. & Rickert V.I. (2002). Physical activity levels among urban adolescent females. *Journal of Pediatric and Adolescent Gynecology*, 15(5), 279-284.

Sharkey, B.J. (2002). *Fitness & Health*. Hong Kong: Human Kinetics Publisher, Inc.

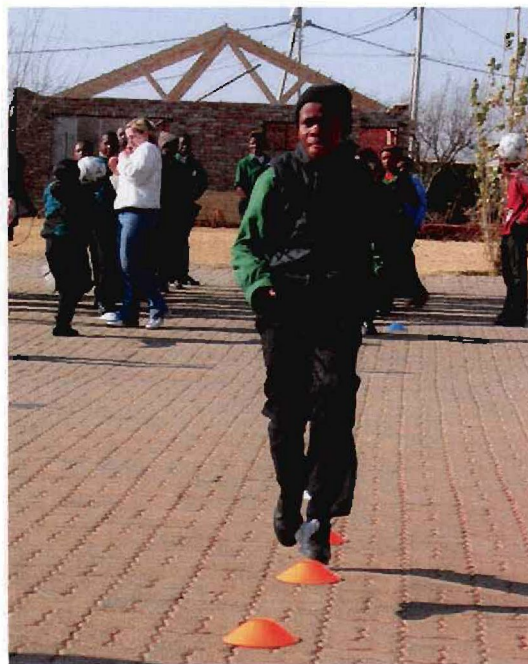
Shropshire J. & Carrol, B. (1998). Final year primary school children's physical activity levels and choices. *European Journal of Physical Education*, 3(2), 156-166.

StatSoft. (2004). Statistica for Windows. Release 5.5: general conversions and statistics. Tulsa, Oklahoma : StatSoft.

Tergerson, J.L. & King, K.A. (2002). Do perceived cues, benefits, and barriers to physical activity differ between male and female adolescents? *Journal of School Health*, 72(9), 374-380.

# CHAPTER 5

**The effect of a physical activity programme on the activity patterns, physical activity levels and aerobic endurance of adolescents from a disadvantaged community: PLAY-study**



## **The effect of a physical activity programme on the activity patterns, physical activity levels and aerobic endurance of adolescents from a disadvantaged community: PLAY-study**

### **Abstract**

The aim of this study was to examine the physical activity choices of adolescent boys and girls from disadvantaged communities during the week and weekend and the effect of a physical activity intervention on their physical activity choices, levels and aerobic endurance. Two hundred and fifty-two (N = 252) black Grade 8 learners (116 boys and 136 girls) with a mean age of 14.8 years ( $\pm 1.43$ ) formed the intervention group while N = 66 Grade 8 learners (21 boys and 45 girls with a mean age of 13.9 ( $\pm 1.04$ )) formed the control group. The results revealed that the average time spent on activities in the intervention programme had a small effect on their physical activity preferences, but some effect on soccer and netball participation. The group with the highest attendance percentage of the intervention programme (>70%) seemed to sustain their aerobic capacity the best. Attendance of high-intensity physical activity programmes during school hours by adolescents living in poor socio-economic environments are recommended due to the many barriers children have to overcome in such environments.

Key words: Intervention programme, adolescents, physical activity

## Introduction

Physical activity impacts on health, and is an important factor for a healthy life style (Pate *et al.*, 1999; Beets & Pitetti, 2004). There are many research reports that confirm that children's physical activity decreases during adolescence, especially in girls (Kemper *et al.*, 2001; Leslie *et al.*, 2001; Neumark-Sztainer *et al.*, 2003; Beets & Pitetti, 2004; Malina *et al.*, 2004). It is also acknowledged in research that children's physical activity levels track into adulthood, indicating that if a child is inactive, physical activity status will most probably be the same in adulthood (Freedson, 1992; Pate *et al.*, 1999; Matton *et al.*, 2006).

Socio-economic background and gender play an important role in an adolescent's physical activity levels and choices. It is indicated that children and adolescents from poorer socio-economic backgrounds have higher levels of physical activity (Prista *et al.*, 1997; Kriska, 2000; Prinsloo & Pienaar, 2003), mainly because they spend more time on household chores that increase their energy expenditure. Regarding gender, researchers (Thomas & Thomas, 1988; Riddoch & Boreham, 1995; Hamlin & Ross, 2005) indicate boys to be more active, probably because they participate in more high-intensity physical activities than girls. Gender also plays a role in the choice of activities; girls prefer more indoor activities, spent with fewer friends (Myers *et al.*, 1996), whereas boys prefer team activities (Faucette *et al.*, 1995; Myers *et al.*, 1996; Hovell *et al.*, 1999). These researchers also found an increase in children's television viewing as they got older. Hancox *et al.* (2004) reported that the average television viewing in the week was negatively associated with adolescents' physical activity. Pate *et al.* (1997) also reported that adolescents who watched television less than one hour were healthier than those who watched television for three or more hours. Trost *et al.* (1999) classified girls who watched more than three hours of television or who played more than three hours of video games, as inactive. However, very few studies regarding physical activity intervention programmes on children were reported (Pangrazi *et al.*, 2003; Roemmich *et al.*, 2004). None of these studies, however, studied the activity choices of the children before and after engaging in such programmes, in an attempt to determine whether the programme would influence the activity choices of children in a way that they chose to be more active.

Children and adolescents must be encouraged to be active on all or most of the days for 30 to 60 minutes at a time to receive health benefits (Winnick, 2005). Because of health risks such as chronic diseases associated with increasing inactivity, it is thus important to find strategies to improve children's physical activity levels. In order to do so it is important to have

knowledge of what kind of activities adolescent boys and girls from disadvantaged backgrounds engage in, not only to understand their physical activity levels better, but also to determine if activity choices will change after intervention. The aim of this study was therefore to examine the physical activity choices in the week and weekend of a group of Grade 8 learners from disadvantaged communities and to determine the effect of a PAIP on their physical activity levels, aerobic endurance and choices.

## Method

### *Research Design*

This research forms part of the multi-disciplinary PLAY-study (Physical Activity in Youth). The study was done on a group of purposefully selected secondary school learners in a township in the North-West Province of South Africa. Two schools participated and all the Grade 8 learners in these schools (N = 252) were asked to form part of this study. The children's parents had to complete an informed consent form, which included complete information about the study, before the children could take part in this study. The study protocol was approved by the Ethics Committee of North-West University (04M01) in Potchefstroom. This was a two-group pre-test/post-test study design with a six months activity intervention (26 weeks). Measurements were completed before the activity intervention at baseline (month 0) and at the end (end of month six).

### *Subjects*

There were 252 black Grade 8 learners (116 boys and 136 girls) with an average age of 14.8 years (standard deviation  $\pm 1.43$ ) from School 1 who formed the intervention group. From School 2 there were 66 Grade 8 learners (21 boys and 45 girls) with an average age of 13.9 (standard deviation  $\pm 1.04$ ) who formed the control group. Fewer learners were involved in the second testing, 216 learners from School 1 (92 boys and 124 girls), and 63 from School 2 (21 boys and 42 girls). The reason for the fewer learners was the learners moved to another school or was sick and did not attend school that day. A demographic questionnaire that each child had to complete indicated that the learners from the two schools were from more or less the same socio-economic status, which could be considered as low.

### *Intervention programme*

The activity intervention programme was conducted twice a week for 60 minutes per session directly after school hours for six months. Although it is desirable to participate in activity sessions three times per week, the programme could only be conducted twice a week for practical reasons. The reasons being, most of these learners (96.4% of School 1 and 92.4% of School 2) walked to school for 30 minutes or more each school day, which was considered a

positive contribution to their everyday physical activity can be seen as an activity session, thus the learners exercised 3 days or more and the programme was done after school hours. The intensity of the programme (energy expenditure) was monitored through accelerometers (Actical, Minimeter, Bend, Oregon), where learners were randomly selected to wear them at every session. The 60 minutes' duration of the programme was divided into 30 minutes of aerobic training, 15 minutes of strength and flexibility training and 15 minutes of sport-related ball skills activities. The sessions started with all the children doing aerobic training (aerobic exercises, dancing, Kata boxing), after which they were divided into two smaller groups, where they participated in strength and flexibility training and sport specific ball skills sessions. Trained post-graduate students in human movement science assisted in conducting the programme and also kept the attendance register during each session. No activity periods were scheduled during school hours, therefore the programme had to be done directly after school hours. Although the children were encouraged to participate in the programme their compliance was voluntary. Attendance of the programme by the learners was calculated into a percentage of the total of 52 sessions and this percentage was used to divide them into attendance groups (see Table 1). From this it can be seen that a very small percentage of the learners attended the programme regularly. Maturation data is also provided in Table 1 as described by the 5 Tanner stages for pubic hair (boys and girls), genital (boys) and breast development (girls) and age of menarche among girls. Stage 1 indicates pre-puberty, stage 2 the initial development of specific gender characteristics, stage 3 and 4 are developing stages and stage 5 the mature developmental stage (Faulkner, 1996).

Table 1

Attendance of the programme, age, gender and biological maturation of the intervention group

Groups	N	%	Age	Boys	Girls	Tanner	Tanner	Tanner	Tanner	% of menarche
						Boys (Hair)	Girls (Hair)	Boys (Gen)	Girls (Breast)	
1 (above 70%)	33	9.11	13.9	5	28	2.2	3.0	2.8	2.7	30.3
2 (50-70%)	56	15.47	14.3	22	34	2.9	3.1	2.7	3.1	39.3
3 (below 50%)	163	45.03	15.1	89	74	3.2	3.5	3.0	3.4	38.7
4 (control group)	66		13.9	21	45	2.9	3.3	2.9	3.1	45.5

(Gen)= Genitals, % of menarche= the percentage of girls who had reached menarche

*Intensity of physical activity (PA) during intervention*

Energy expenditure during each session (two times/week) was evaluated using accelerometers (Actical, Mini-Mitter Co, Inc Bend, OR) because the aim of the aerobic session was to keep the children in the moderate-to-high intensity zone for at least 30 minutes. A total of six accelerometers were used and attached to different children each time. The monitors were affixed above the iliac crest of the right hip with an elastic belt and adjustable buckle, according to manufacturer's instructions and recommendations and always oriented upwards. Activity level during exercise was expressed in activity counts accumulated for one minute units and the total was saved in the accelerometer's memory. Energy expenditure was evaluated using the Actical software in METs (Metabolic Equivalent) (Puyau, 2002; Ainsworth, 1993). Because the activity intervention relied on different levels of physical activity model 2R was applied to calculations of energy expenditure (Actical Software Instruction Manual, 2003). To describe physical activity intensity the following cut-points (METs) were used: light (light < 2.7), moderate (mod 2.7 - 4.4), vigorous (vig > 4.4) (Actical Software Instruction Manual). Data was expressed as activity counts (AC) as well. Table 2 gives an indication of the mean energy expenditure during the time of each session over the period of six months. Table 2 summarises the results and indicates that the group spent on average 58.5% of the 54.7 minutes on moderately intensive activities and 14.8% on vigorously intensive activities, averaging 40.1 minutes of the 54.7 minutes in the moderate to high physical activity zone.

Table 2

Mean energy expenditure during the activity sessions over the 6-months intervention programme

	Mean	SD	Minimum	Maximum
Time monitored (minutes)	54.7	7.51	45.00	71.0
%Time (sed)*	1.2	1.89	0.00	6.7
%Time (light)	25.4	14.28	2.22	54.2
%Time (mod)	58.5	13.50	32.20	82.0
%Time (vig)	14.8	12.11	1.72	44.8
EE (sed) (kcal)#	0.5	0.80	0.00	3.1
EE (light) (kcal)	19.2	13.02	1.29	62.2
EE (moderate) (kcal)	83.8	25.37	39.85	126.2
EE (vigorous) (kcal)	31.0	29.51	3.11	109.4
Total EE (kcal)	134.4	32.70	73.25	209.3

EE - energy expenditure, % Time – total accumulated minutes each activity range within the given interval, divided by time interval duration, multiplied by 100, \*=categorised according to the software of Actical® accelerometer, #= energy expenditure calculated by Achcal® software Measuring Instruments

#### *The Previous Day Physical Activity Recall (PDPAR)*

The Previous Day Physical Activity Recall (PDPAR), compiled by Trost *et al.* (1999), was used to gather data in connection with the children's physical activities of the previous day (that is a 24-hour recall questionnaire) for a weekday and one day during the weekend. According to this the children's physical activity level was classified as low (1), moderate (2) or high (3). The children had to recall activities they had done for every half hour. The activities were coded with METs (Metabolic Equivalents = 1 MET is the energy consumption associated with rest and equal to 1 kkal/kg/uur, sleep = 0.9) values for each activity. The activities were categorised in groups such as : grooming (A), transport (B), work indoors (C), work outdoors (D), recreational activities (E), physical activity (F), sport (G), recreational games (H) and other (I). Only activities which took up to 0.5% and more of the time, are presented in tables.

#### *Bleep test*

The Bleep test is an indirect measurement of  $VO_2$ -max. The aerobic capacity is determined by a 20m multistage running, with a progressive increase in pace (Brewer *et al.*, 1988). When a participant could no longer complete a lap within the required time, he/she was stopped and the number of 20m laps completed was recorded.

### *Maturity*

Sexual maturity was assessed by using the 5-stage Tanner scale for breast development, pubic hair and age of menarche in females and for pubic hair and genital development in males (Faulkner, 1996). Age of menarche was also established.

### *Data Processing*

The activities that the children engaged in were analysed using the SAS-program (SAS, 1991) that arranged the activities by order of highest occurrence and average number of half hour intervals spent on that activity. The descriptive data was analysed by means of Statistica for Windows (StatSoft Inc SA, 2004), including means, standard deviations (SD) and maximum and minimum values as well as Tuckey post hoc analysis for the significant differences between variables for the three attendance groups and the control group.

### *Results*

Table 3 displays the activity profiles of the intervention and control groups during the week during baseline and after the intervention group had participated in the intervention programme. This shows that the activity choices of both groups were more or less the same during both testing periods. The only activities engaged in by the groups with energy expenditure of more than three METs were soccer and fast walking and these activities took only 6% of their time on average. Fast walking was most probably done to get to school during the week and not done by choice, as can be seen from the time spent on fast walking at baseline during the week (3.6% intervention group and 3.4% control group) and weekend (1.4% intervention group and 1.6% control group), Table 4. The intervention group showed an increase in their time spent on soccer, (3% before and 4% after participation in the programme), while the soccer participation in the control group decreased from baseline (3%) to the end (1.8%). Time spent on netball, remained at a low percentage before and after (0.7% - 0.5%) the programme in the intervention group, although no netball playing was observed in the control group. Doing homework and watching television took up most of the time of both groups at baseline (23.6% and 11.8% intervention group, 25.3% and 15.8% control group). Small percentages of time playing basketball (0.9%) and rope jumping (0.7%) was however indicated in the control group which was not the case in the intervention group. Both groups' percentage time spent watching TV increased between baseline and end testing (11.8 - 15.7%, intervention group), although the control group spent more time watching TV before and after the programme (15.8 - 17.3%). It also seems that learners from both schools engaged in more recreational and indoor activities during the week than during weekends. The two activities

taking up the highest percentage of both groups' time during the week at baseline and the end were in the recreational activities category.

During the weekend (Table 4) time spent on watching TV increased (19.6 - 24.2%) in the intervention group and control group (21.8 - 26%). The intervention group's soccer participation remained similar over the weekend, from baseline to the end (5 - 5.6%), while a decrease in soccer participation during follow-up (3.4 - 1.8%) was indicated in the control group. The netball participation in the intervention group decreased slightly (1.1 - 0.8%) but some participants also participated in tennis (0.8%) during the end testing. The control group did not participate in netball or any other type of sport at baseline but they did spend time on recreational swimming (2.3%) and rope jumping (0.9%) that have high METs values. It also seemed that adolescents in the intervention group (5.3 - 6.2%) had to perform more house chores than the control group (3.7 - 3.7%) during the weekend. Fast walking also decreased in both groups during the weekend from baseline to the end. There were also decreases in fast walking from the week to the weekend, which could most probably be explained by the fact that they walked to school during the week.



Table 4

Activities done by the adolescents in both schools during the weekend at base line and after the intervention programme

Intervention group	Baseline									End														
	Activities	MET	M	%	A	Control group	Activities	MET	M	%	A	Intervention group	Activities	MET	M	%	A	Control group	Activities	MET	M	%	A	
					G					G								G						G
TV	1.5	.196	19.6	E	TV	1.5	.218	21.8	E	TV	1.5	.242	24.2	E	TV	1.5	.260	26	E					
Sleep	0.9	.110	11.0	A	Sleep	0.9	.165	16.5	A	Sleep	0.9	.142	14.2	A	Sleep	0.9	.134	13.4	A					
Eat/Drink	1.5	.075	7.5	A	Eat/Drink	1.5	.076	7.6	A	Chores	2.1	.062	6.2	C	Church	1.5	.097	9.7	H					
Walk slow	2.8	.060	6.0	B	Wash	2.0	.051	5.1	A	Eat/Drink	1.5	.057	5.7	A	Eat/Drink	1.5	.088	8.8	A					
Chores	2.1	.053	5.3	C	Friends	1.5	.045	4.5	H	Soccer	7.0	.056	5.6	G	Friends	1.5	.056	5.6	H					
Soccer	7.0	.050	5.0	G	Chores	2.1	.037	3.7	C	Walk slow	2.8	.052	5.2	B	Wash	2.0	.046	4.6	A					
Friends	1.5	.048	4.8	H	Walk slow	2.8	.035	3.5	B	Sit, still	1.0	.042	4.2	A	Walk slow	2.8	.044	4.4	B					
Church	1.5	.048	4.8	H	Soccer	7.0	.034	3.4	G	Church	1.5	.037	3.7	H	Chores	2.1	.037	3.7	C					
Wash	2.0	.048	4.8	A	Church	1.5	.030	3.0	H	Wash	2.0	.035	3.5	A	Swim (recreation)	5.0	.023	2.3	H					
Sit, still	1.0	.046	4.6	A	Sit, still	1.0	.026	2.6	A	Friends	1.5	.031	3.1	H	Read	1.3	.022	2.2	E					
Cooking	2.1	.026	2.6	C	Sing	2.0	.026	2.6	H	Cooking	2.1	.029	2.9	C	Soccer	7.0	.018	1.8	G					
Sing	2.0	.018	1.8	H	Talk, phone	1.5	.024	2.4	C	Wash clothes	3.0	.019	1.9	C	Cooking	2.1	.018	1.8	C					
Walk fast	5.0	.014	1.4	B	Cooking	2.1	.021	2.1	C	Sing	2.0	.017	1.7	H	Sit, still	1.0	.014	1.4	A					
Wash clothes	3.0	.014	1.4	C	Play cans	3.0	.018	1.8	H	Listen, music	1.5	.014	1.4	E	Walk fast	5.0	.014	1.4	B					
Homework	1.8	.013	1.3	E	Walk fast	5.0	.016	1.6	B	Do dishes	1.6	.012	1.2	C	Play cans	3.0	.010	1.0	H					
Do dishes	1.6	.013	1.3	C	Read	1.3	.014	1.4	E	Walk fast	5.0	.010	1.0	B	Sing	2.0	.010	1.0	H					
Listen, music	1.5	.012	1.2	E	Games	1.5	.013	1.3	I	Talk, phone	1.5	.009	0.9	E	Swing	2.8	.009	0.9	H					
Read	1.3	.011	1.1	E	Do dishes	1.6	.012	1.2	C	Watch movies	1.5	.008	0.8	E	Rope jump	10.0	.009	0.9	H					
Netball	6.0	.011	1.1	G	Listen, music	1.5	.011	1.1	E	Netball	6.0	.008	0.8	G	Do dishes	1.6	.009	0.9	C					
Transport	1.5	.005	0.5	B	Play cards	1.5	.010	1.0	E	Tennis	7.0	.008	0.8	G	Ironing	2.3	.007	0.7	C					

AG=Activity group, M = Mean, grooming (A), transport (B), work indoors (C), work outdoors (D), recreational activities (E), physical activity (F), sport (G), recreational games (H) and other (I)

As a next step, the data were analysed according to the three attendance groups (group 1, above 70%, group 2, 50-70%, group 3, below 50%, as well as group 4, which was the control group), to explore the impact of the programme on their physical activity levels. Table 5 displays the energy expenditure, physical activity levels and aerobic capacity of the four different groups. These results indicate little differences between the energy expenditure at baseline and follow-up between the different attendance groups and the control group. The PDPAR physical activity values indicate that the adolescents in all the intervention groups and the control group were on average moderately active during the week and the weekends, both during baseline and end testing although the control group had the lowest values. Significant differences were found between group 1 and 4 ( $p = 0.020$ ) during the weekend at baseline and group 3 and 4 ( $p = 0.007$ ) in their PDPAR values at the end and also during the weekend (Table 5). The PDPAR category values stayed more or less the same in all the groups from baseline to follow-up, during the week and the weekend. In all the groups the TV viewing hours increased during the week and weekend from baseline to the end testing and group 4 showed the highest TV viewing hours. The sum of METs values of group 1 show the biggest increase during the week from baseline to the end testing ( $p > 0.05$ ). Group 1 sustained their activity levels during the week and increased their sum of METs values. This result is supported by the findings of Table 3 where it is indicated that the intervention group participated more in soccer and netball. These skills were practised in the intervention programme as part of the ball skills section, which might have contributed to these choices.

The group with the highest attendance rate was the youngest group and consisted of more girls than boys (Table 1). It is also seen from this table that they were in an earlier maturation stage than the other groups. Their physical activity level was moderate during the week and their sum of METs increased at the end testing. The aerobic capacity of this group as measured by the Bleep test also stayed the same from baseline to end testing, while tendencies of decreasing values were evident in the other groups. According to these results it would seem that the programme had little effect on the children's PA levels.

Table 5

Difference between baseline and end testing in energy expenditure of the different attendance groups in the intervention group and the control group during the week and weekend

WEEK	Baseline									End								
	Group 1 (n=33)		Group 2 (n=56)		Group 3 (n=163)		Group 4 (n=66)		p	Group 1		Group 2		Group 3		Group 4		p
	M	SD	M	SD	M	SD	M	SD		M	SD	M	SD	M	SD	M	SD	
Σ METs/ 16h*	79.6	13.52	81.43	12.69	83.04	13.6	84.12	14.1		81.86	13.99	82.05	17.78	82.92	15.81	84.7	16.62	
PA	2.0	0.92	2.2	0.83	2.3	0.82	1.92	0.89		2.0	0.85	2.1	0.85	2.2	0.81	1.94	0.81	
TV hours	1.7	1.33	1.7	1.26	1.9	1.41	2.44	1.35	1,4	2.7**	1.54	2.3**	1.89	2.4**	1.78	2.68	1.55	
Bleep	4.6	1.66	5.5	1.78	5.5	2.01	4.45	1.60	2,4 & 3,4	4.5	1.47	5.0	2.28	5.09	2.27	4.07	1.64	3,4
WEEKEND	Baseline									End								
	Group 1 (n=33)		Group 2 (n=56)		Group 3 (n=163)		Group 4 (n=66)		P	Group 1		Group 2		Group 3		Group 4		
	M	SD	M	SD	M	SD	M	SD		M	SD	M	SD	M	SD	M	SD	
Σ of METs	74.32	16.13	78.66	19.33	77.37	19.6	73.40	20.7		75.08	19.98	76.75	21.97	75.85	17.74	77.8	18.57	
PA	2.4	0.79	2.2	0.90	2.1	0.89	1.80	0.85	1,4	2.0**	0.88	2.0	0.91	2.2	0.89	1.66	0.81	3,4
TV hours	2.5	1.48	3.2	1.95	3.1	2.14	3.39	2.40		3.7**	1.76	3.7	2.05	3.7**	2.27	4.01	2.04	

Group 1=above 70%, Group 2=50-70%, Group 3= below 50%, Group 4= Control group, \*=16h – measurement period for PDPAR, \*\*= p<0.05 (differences between, Σ METs/16h, PA = PDPAR physical activity category (physical activity according to level)

## Discussion

The effect of the activity intervention on the physical activity levels and activity choices of the group of learners who participated in the intervention should be evaluated against the background of many factors that might have played a role in the results. Although the parents and children all consented to participate in the programme, attendance of the intervention programme directly after school hours for two days of the week was not compulsory. Only 33 children, who were mainly girls, and also the youngest and the less biologically mature (when compared to the other groups), attended the programme on a regular basis (70% attendance and more). The compliance of this group to the programme could possibly be explained by the fact that the group consisted of younger girls who still enjoyed physical activity and who were indicated in the literature to be more active than older girls (Neumark-Sztainer *et al.*, 2003:803; Hamlin & Ross, 2005:32). Furthermore, a higher preference for aerobic and dance-related exercises, which formed a big part of the programme, might also have contributed to the higher number of girls in this group.

These children came from low socio-economic backgrounds where children had to perform many chores at home. As the programme had to be attended after school hours, such commitments might have prevented some more than others from participating in the programme on a regular basis. The younger children might have fewer responsibilities, like looking after younger brothers and sisters, contributing to the fact that they could attend the programme more regularly. Barriers such as school homework, home responsibilities and duties around the house that were beyond their control could have prevented the group from regular participation. Lennox *et al.* (2007) investigated reasons for poor attendance where learners indicated that parents' encouragement and understanding of the importance of physical activity would have motivated them to participate more in PA. However, duties at home after school would definitely have higher priorities among parents for free time. Distances from 3 to 5 kms that these children had to walk to school each day (adding up to 6 to 10 km each day) could also be tiring, and this might also have played a role in the low attendance rate of the group. To choose to participate in an activity programme with a high intensity level for an hour after school and then to still walk back home might have been too much to ask from them. The fact that they choose to engage in sedentary activities like TV viewing after school hours is therefore not too surprising.

Taking into consideration the small percentage of children who attended the programme on a regular basis, and the fact that these children were already moderately active as a group, one can conclude from the results that the intervention programme had little effect on the adolescent's activity choices, especially activities that would increase their PA levels, as no significant increases in PA levels were found. This could be seen in the intervention group where soccer skills were part of the programme, which could have influenced their choice of activity. However, times spent on sedentary activity choices, like TV viewing, increased in both schools during the week and the weekend, which is not too surprising. This pattern was also seen in the group with the highest attendance, although this group's energy expenditure during the exercise intervention, physical activity levels and their aerobic capacity stayed the same (influence of the aerobic activities in the intervention programme) compared to the other groups where tendencies of lower physical activity and aerobic endurance were noted. Most of the sum of METs values increased during the week, but decreased during the weekend from baseline to the end testing, which could possibly be explained by the children's mode of transport to school. Taking maturity into consideration, aerobic endurance should have increased, especially among boys (Malina *et al.*, 2004). Furthermore, more time was spent on sports skills, especially soccer and netball in the intervention school, (regardless of their attendance of the programme), from which it can be concluded that the part of the programme where such sport specific skills were practised might have influenced these choices.

Recommendations from these results are that more information on health and physical activity behaviour should be given to parents and adolescents. The activities done in the programme were chosen by the adolescents, but to get more adolescents, especially boys to participate in this kind of programme, other types of aerobic activities must be considered. More sports-skills related activities can for instance be introduced to capture the interest of boys. It is also recommended that physical education classes should be re-introduced into the school curriculum so that all children can benefit from activity programmes and this will also provide the necessary time to teach them about health, physical activities and the risk factors of inactivity. Participating in an after school physical activity programme was not the answer to improving physical activity in this previously disadvantaged community. Including physical activity programmes during school hours will be necessary to overcome the many barriers children have to overcome in low socio-economic environments.

## References

- Actical Software Instruction Manual. Mini Mitter Company. Inc. Bend OR USA. Actical Physical Activity Monitoring System Software V.2.0.
- Ainsworth, B., Haskell, W.L. & Leon, A.S. (1993). Compendium of physical activities: classification of energy costs of human physical activities. *Medicine & Science in Sport & Exercise*; 25:71– 80.
- Beets, M.W. & Pitetti, K.H. (2004). One-mile run/walk and body mass index of an ethnically diverse sample of youth. *Medicine & Science in Sport & Exercise*, 36(10):1796-1803.
- Brewer, J., Ramsbottom, R. & Williams, C. (1988). Multi-stage fitness test. Belconnen Act : Australian Coaching Council. 10 p.
- Faucette, N., Sallis, J.F., McKenzie, T.L., Alcaz, J., Kolody, B. & Nugent, P. (1995). Comparison of fourth grade students' out-of-school physical activity levels and choices by gender: project SPARK. *Journal of Health Education*, 26(2):S82-S90, March/April (Supplement).
- Faulkner, R.A. (1996). Maturation. In *Measurement in pediatric exercise science*. (Edited by D. Docherty). *Measurement in pediatric exercise science*. Champaign, Ill.: Human Kinetics, 129-155.
- Freedson, P.S. (1992). Physical activity among children and youth. *Canadian Journal of Sport Science*, 17(4):280-283.
- Hamlin, M.J. & Ross, J.J. (2005). Barriers to physical activity in young New Zealanders. *Youth Studies Australia*, 24(1):31-37.
- Hancox, R.J., Milne, B.J. & Poulton, R. (2004). Association between child and adolescent television viewing and adult health: a longitudinal birth cohort study. *The Lancet*, 64(9430):257-262, 17 July.
- Hovell, M.F., Sallis, J.F., McKenzie, T.L. & Kolody, B. (1999). Children's physical activity choices: a developmental analysis of gender, intensity levels, and time. *Pediatric Exercise Science*, 11:158-168.
- Kemper, H.C.G., Twisk, J.W.R., Koppes, L.L.J., Van Mechelen, W. & Post, G.B. (2001). A 15-year physical activity pattern is positively related to aerobic fitness in young male and females (13-27 years). *European Journal of Applied Physiology*, 84:395-402.
- Kriska, A. (2000). Ethnic and cultural issues in assessing physical activity. *Research Quarterly for Exercise and Sport*, 71(2):47-53.
- Lennox, A., Pienaar, A.E. & Coetzee, M. (2007). Barriers, motivators, sport

participation and perceptions of physical activity among adolescents living in semi-urban surroundings. *African Journal for Physical, Health Education, Recreation and Dance*, 289-303. Sept.

Leslie, E., Fotheringham, K.J., Owen, N. & Bauman, A. (2001). Age-related differences in physical activity levels of young adults. *Medicine & Science in Sport & Exercise*, 33(2):255-258.

Malina, R.M., Bouchard, C., BAR-OR, O. (2004). Growth, maturation and physical activity. Champaign, Ill, USA : Human Kinetics, 712 p.

Matton, I., Thomis, M., Wijndaele, K., Duvigneaud, N., Beunen, G., Claessens, A.L., Vanreusel, B., Philippaerts, R., Lefevre, J. (2006). Tracking of physical fitness and physical activity from youth to adulthood in females. *Medicine & Science in Sports & Exercise*, 38(6):1114-1120.

Myers, L., Strikmiller, P.K., Webber, L.S. & Berenson, G.S. (1996). Physical and sedentary activity in school children grades 5-8: the Bogalusa heart study. *Medicine & Science in Sports & Exercise*, 28(7):852-859.

Neumark-Sztainer, D., Story, M., Hannan, P.J., Tharp, T. & Rex, J. (2003). Factors associated with changes in physical activity: a cohort study of inactive adolescent girls. *Archives of Pediatrics & Adolescent Medicine*, 157:803-810. August.

Pangrazi, R.P., Beighle, A., Vehige, T. & Vack, C. (2003). Impact of promoting lifestyle activity for youth (PLAY) on children's physical activity. *Journal of School Health*, 73(8):317-321.

Pate, R.R., Trost, S.G., Dowda, M., Ott, A.E., Ward, D.S., Saunders, R. & Felton, G. (1999). Tracking of physical activity, physical inactivity and health-related physical fitness in rural youth. *Pediatric Exercise Science*, 11:364-376.

Pate, R.R., Trost, S.G., Felton, G.M., Ward, D.S., Dowda, M. & Saunders, R. (1997). Correlates of physical activity behaviour in rural youth. *Research Quarterly for Exercise and Sport*, 68(3):241-248.

Prinsloo, A. & Pienaar, A.E. (2003). Prevalence of developmental co-ordination disorder and influences of physical activity levels and body composition in the children of farm workers: FLAGH study. *African Journal for Physical, Health Education, Recreation and Dance*, 9(1):151-164.

Prista, A., Maia, J.A.R. & Marques, A.T. (1997). The relationship between physical activity, socio-economic status and physical fitness of 8-15 year old youth from Mozambique. *American Journal of Human Biology*, 9:449-457.

Puyau, M.R., Adolph, A.L., Vohra, F.A. & Butte, N.F. (2002). Validation and calibration of physical activity monitors in children. *Obesity Research*, 10:150–157.

Riddoch, C.J. & Boreham, C.A.G. (1995). The health-related physical activity of children. *Sports Medicine*, 19(2):86-102.

Roemmich, J.N., Gurgol, C.M. & Epstein, L.H. (2004). Open-loop feedback increases physical activity of youth. *Medicine & Science in Sport & Exercise*, 36(4):668-673. April.

SAS Institute Inc. The SAS System for Windows Release 9.1 TS Level 1M0 Copyright© 2002-2003 by SAS Institute Inc., Cary, NC, USA.

StatSoft. (2004). *Statistica for Windows. Release 5.5: general conversions and statistics.* Tulsa, Oklahoma : StatSoft.

Thomas, R. & Thomas, K.T. 1988. Development of gender differences in physical activity. *QUEST*, 40:219-229.

Trost, S.G., Pate, R.R., Ward, D.S., Saunders, R. & Riner, W. 1999. Determinants of physical activity in active and low-active, sixth grade African-American youth. *Journal of school health*, 69(1):29-34. Available: Academic Search Premier.

Trost, S.G., Ward, D.S., McGraw, B. & Pate, R.R. 1999. Validity of the previous day physical activity recall in fifth-grade children. *Pediatric exercise science*, 11:341-348.

Winnick JP. (2005). *Adapted physical education and sport.* 5<sup>th</sup> ed. Champaign, Ill : Human Kinetics.

# CHAPTER 6

**The effect of a physical activity programme (PLAY) on the physical fitness of stunted adolescents from a disadvantaged community: PLAY-study**



**The effect of a physical activity programme (PLAY) on the physical fitness of stunted adolescents from a disadvantaged community: PLAY-study**

Short running title: Physical fitness of stunted adolescents

Lennox A.<sup>1</sup>, Pienaar A.E.<sup>1</sup>, Kruger H.S.<sup>2</sup> & Wilders C.J.<sup>1</sup>

<sup>1</sup>School of Biokinetics, Recreation and Sport Science, <sup>2</sup>School of Physiology, Nutrition and Consumer Science, North-West University (Potchefstroom campus), South Africa

Corresponding author:

Prof. A.E. Pienaar

e-mail: [Anita.Pienaar@nwu.ac.za](mailto:Anita.Pienaar@nwu.ac.za)

Fax number: +27 (0) 18 2991796

## Abstract

*Background:* Various negative long-term consequences of stunting are reported in the literature.

*Aims:* This study aimed to determine if changes in physical fitness (PF) were different among stunted and non-stunted adolescents after participation in a physical activity (PA) intervention programme.

*Methods:* Two hundred and fifty-two (N = 252) learners categorised into a stunted (S) (14.7%) and non-stunted (NS) (66.7%) group (HAZ <-0.2) and into three different attendance groups (>70%, 50-70%, <50%) from an intervention school (School 1) participated in a PAIP and their results were compared to a control group (School 2) of N = 66 learners from another school. One and two-way Analysis of Covariance (ANCOVA) and a Tuckey-Kramer multiple comparisons were done to analyse the data. Boys and girls were analysed separately because different co-variables were used.

*Results:* The results indicated that the stunted girls who participated regularly (>70%) showed better improvement in aerobic capacity and hand grip strength compared to NS girls, while lean body mass and hip flexibility (R) improved more in stunted boys.

*Conclusions:* Although few differences in physical fitness were found between stunted and non-stunted adolescents, the results did indicate that a physical activity intervention might be of benefit to stunted learners.

## Introduction

Physical fitness (PF) and physical activity (PA) are two of the most important factors for sustaining a healthy living from childhood to adulthood<sup>1</sup>. There are many consequences of being in a poor fitness state and being inactive. These include non-communicable diseases such as obesity, cardiovascular disease (CVD), diabetes and other risk factors<sup>2,3,4</sup> among youth. High levels of psychological well-being, development of a positive self-concept, improved health and meeting all the demands of physical work are also associated with higher levels of physical activity<sup>5,6</sup>. Studies indicate relationships between physical activity, aerobic fitness<sup>7,8,9</sup> as well as between other fitness components such as flexibility and strength, and PA<sup>9,10</sup>. Relationships between PA and body composition have also been investigated<sup>9,11</sup>. However, no research findings of such possible relationships between PA and PF have been reported among stunted adolescents. Research indicating lower systolic blood pressure levels, aerobic capacity, muscle strength and poorer leg mineral density among stunted children was, however, found<sup>12,13,14</sup>.

Studies suggest that children and adolescents from rural areas are more stunted than children from urban areas<sup>15,16</sup>. It was also found by Cameron<sup>17</sup> that black rural South African children aged 6-18 years were more stunted than American children of the same age group, and that this tendency occurred throughout childhood into late adolescence. One of five (19%) girls in the North-West Province of South Africa in the age group between 10–15 years were reported by Kruger<sup>18</sup> to be stunted, while Mamabolo<sup>19</sup> indicated percentages of 20% among boys and 12% among girls, between 12-18 years of age, also from the North-West Province, as being stunted. Friedman<sup>20</sup> reported 21.6% boys and 15.3% of girls under 13 years of age to be stunted in Western Kenya with an overall percentage of 18.3%. Stunted children, especially girls, seem to store relatively more fat than non-stunted girls<sup>18</sup> therefore PA seems necessary to prevent this tendency.

Intervention studies are reported to improve children's stunting. These include studies on food-supplementation<sup>21</sup> and nutrition education<sup>22</sup>. However, none of these studies investigated the effect of a PAIP on stunting or the relationship between PA and PF among stunted adolescents. The aim of this study was therefore to determine if changes in PF were different among stunted and non-stunted adolescents after participation in a PA intervention programme.

## **Research Design**

This research forms part of multi-disciplinary PLAY-study (Physical Activity in Youth). The study was carried out on a group of purposefully selected secondary school children in a township in the North-West Province of South Africa in a pre-test post-test study design. The intervention school (School 1) was selected, based on the view of the district Health Department that this school had the highest proportion of stunted children. A nearby high school from similar circumstances was selected as a control school (School 2). A six months physical activity intervention in a group of 252 children, aged 13-16 years was done in the intervention school, where children participated in physical activity sessions twice a week for an hour. Measurements were completed before the activity intervention at baseline (month 0) and at the end (end of month 6, 26 weeks) in both intervention and control schools. All the Grade 8 learners in the schools were invited to participate in the study. The children's parents were informed about the study at parents' meetings, where they had the opportunity to ask questions and also received written information about the study. Parents as well as children signed an informed consent form before the children could take part in this study. The study was approved by the Ethics Committee of the North-West University in Potchefstroom, South Africa (project number 04M01). Trained post-graduate students in human movement science assisted with the programme.

## **Intervention programme**

The school denied permission to conduct the programme during school hours, and asked that all learners in Grade 8 should be included in the study if they consented. The intervention programme was therefore conducted twice a week for 60 minutes per session directly after school hours. For practical reasons the programme could only be done twice a week. The reasons being, it was after school hours and most of these learners (96.43% of the experimental group and 92.42% of the control group) walked to school for thirty minutes or more each school day and could be seen as an activity session, thus the learners exercised for 3 days and more. Literature indicates that children should be physically active on all or most of the days for 30-60 minutes per session, according to this the 60 minute duration of the programme was divided into 30 minutes of aerobic training, 15 minutes of strength and flexibility training and 15 minutes of ball skills related exercises. Aerobic training was done because it was the best way to get the learners moderate to highly active and it form part of the health related physical fitness components with strength and flexibility. Ball skills were done to improve ball skills. The sessions started with all the participants doing aerobic training, after which the participants were divided into two smaller

groups where they participated in strength and flexibility training and ball skills related exercises. The aerobic training included dancing, Kata boxing, and aerobic exercises and the intensity of the activity session was set at a heart rate level of between 115 – 180 beats per minute<sup>23</sup>. Energy expenditure (the intensity of the programme) was monitored through accelerometers<sup>24</sup>, worn by adolescents at each session. Although the children were motivated to participate in the programme their participation was voluntary, as the programme had to be done directly after school hours. The children were divided into smaller groups according to their school classes, and an attendance register was kept by the research assistants.

## **Subjects and methods**

### **Subjects**

There were 252 black Grade 8 learners (116 boys and 136 girls) in the intervention group (EG) and 66 learners (21 boys and 45 girls) in the control group (CG). Average attendance during the six month intervention programme was 39%. Most of these learners walked to school (96.43% - intervention group), of which 35.3% walked 500m - 2 km, 50.8% walked 3 - 5 km and, 98.5% of learners in the control group walked 500m - 2 km. These distances took between 15 and 45 minutes to cover each day. All participants were classified into stunted (N=42, boys=23, girls=19) and non-stunted (N=229, boys=88, girls=141) groups using the z-score for height-for-age.

### **Measurements**

#### **Body composition**

Body composition of each subject was measured by air displacement plethysmography. Measurements were performed using the BOD POD system<sup>25</sup> according to manufacturer's instructions and recommendations, with each subject wearing a tight-fitting swimsuit and swim cap<sup>26, 27, 28</sup>. After calibration children were shown how to use the thoracic gas volume tubes and measurements were done with adjustment for lung volume. The children were weighed on the BOD POD's electronic scale and body density was calculated. Body density was used to calculate percentage body fat according to the model of Siri<sup>29</sup>.

#### **Anthropometrical measurements**

The subjects were examined in their underwear for the anthropometrical measurements. Weight was measured on a portable electronic scale (Precision Health Scale, A&D Company, Tokyo, Japan) to the nearest 0.1 kg and height was measured to the nearest 0.5

cm with a stadiometer (IP 1465, Invicta, London, UK). Subjects were without shoes, stood upright with their heads in the Frankfort plane for height measurements<sup>30</sup>. The Body Mass Index (BMI) (kg/m<sup>2</sup>) was calculated as weight divided by height squared. Circumferences (waist and hip) were measured with the cross-hand technique, with the tape at right angles to the body segment that was being measured and with no indentation of the skin<sup>30</sup>. The waist circumference (WC) was measured at the midpoint between the lower rib margin and the iliac crest, and the hip circumference (HC) was measured at the maximal circumference of the buttock with a 7mm-wide flexible steel tape (Lufkin, Cooper Tools, Apex, NC). Waist: hip ratio (WHR) was calculated from the waist and hip circumferences. The skinfolds were measured in duplicate to the nearest 0.5mm using a Harpenden caliper at four sites: triceps (TSF), subscapular (SSF), calf (CalfSF) and supraspinal (SupSF) and average values were calculated. All the anthropometric measurements were made by trained biokineticists. Stunting was defined according to the World Health Organisation (WHO) as a Z - score (height-for-age)  $\leq$  -2.0.

### **Maturity**

Sexual maturity was assessed by using the 5-stage Tanner scale. Breast and pubic hair development and age of menarche in females were assessed and pubic hair and genital development in males<sup>31</sup>. Stage 1 of the Tanner scale indicates pre-puberty, stage 2 the initial development of specific gender characteristics, stage 3 and 4 are developing stages and stage 5 indicates the mature developmental stage.

### **Intensity of physical activity (PA) during intervention**

Energy expenditure during each session (twice/week) was evaluated using accelerometers<sup>24</sup>. The monitors were affixed above the iliac crest of the right hip with an elastic belt and adjustable buckle, according to manufacturer's instructions and recommendations and always oriented upwards. Activity level during exercise was expressed in activity counts (number of Actical counts) accumulated for one minute units and the total was saved in the accelerometers' memory. Energy expenditure was evaluated using the Actical software in METs (Metabolic Equivalents)<sup>32, 33</sup>. Because the activity intervention relied on different levels of physical activity model 2R was applied to calculations of energy expenditure<sup>24</sup>. To describe physical activity intensity the following cut-points (METs) were used: light (light < 2.7), moderate (moderate 2.7-4.4), vigorous (vigorous >4.4)<sup>24</sup>. Data were expressed as activity counts (AC) – as well. The average energy expenditure during the programme was 134.4 kcal (564kJ).

## **Fitnessgram**

The physical fitness of the group was measured by means of the Fitnessgram and a few additional physical fitness tests. The Fitnessgram is a physical fitness test that measures the physical fitness level of children from five years to 17 and older<sup>34</sup>. The sub tests of the fitnessgram that were used and measured according to the protocol of this test battery were the following:

*PACER (boys and girls):* This test measures aerobic capacity and is determined by a 20m multi-stage shuttle run, with a progressive increase in pace. When a participant can no longer complete a lap within the required time, he/she is stopped and the number of completed 20m laps is recorded.

*Curl-ups (boys and girls):* This test measures abdominal strength and endurance. The objective is to do as many curl-ups as possible at a predetermined rate of one curl-up every three seconds. An age-appropriate measuring strip was used to ensure the correct execution of the curl-ups. The score is the number of correct curl-ups performed.

*Trunk lift (boys and girls):* This test measures trunk extensor strength and flexibility. The objective is to raise the torso as high as possible from the floor from a prone position, while keeping the eyes on an object in line with the eyes on the floor. This position is held while the distance from the floor to the chin is measured in centimeters.

*Push-ups (boys and girls):* This test measures upper body strength and endurance. The participant has to do as many push-ups (where the torso must touch the floor with each push-up) as possible at a predetermined rate of approximately 20 push-ups per minute or one every three seconds. The total number of push-ups is recorded.

*Pull-ups (boys):* This test measures upper body muscle strength. The objective of the test is to do as many pull-ups from a straight hanging position on a bar. The correct number of pull-ups (which require that the chin must be above the bar), is recorded<sup>34</sup>.

*Flexed arm hang (girls):* This test measures arm and shoulder strength and endurance. Girls have to hang with bent arms and the chin above the bar for as long as possible. The number of seconds that the chin remains above the bar is recorded<sup>34</sup>.

*Back saver sit-and-reach (boys and girls):* This test measures the flexibility of the lower back and hamstrings. The flexibility of the right-leg and left-leg are measured separately. It is required to sit at the sit-and-reach box with the sole of the left foot against the box and the right foot flat on the floor with the right knee bent. Sit with arms forward with one hand over the other, palms facing downwards, resting on the measuring tape of the box. The participant has to stretch as far forward as possible four times, and hold the position for one

second during the fourth attempt. The farthest distance which can be reached is recorded in centimeters<sup>34</sup>.

The Fitnessgram uses criterion-referenced standards to establish fitness status. Scores are classified into two main areas: the Needs Improvement Zone (or at-risk-fitness) and the Healthy Fitness Zone (HFZ). Everybody should strive to be classified into the HFZ which includes a range of scores in each of the tests.

### **Additional fitness tests**

These tests were done to compare this results with other studies and to get better insight in the adolescence physical fitness and it consisted of the following measurements:

*Left and right hand grip strength:* This was measured by the Lafayette-hand grip dynamometer<sup>35</sup>. The dynamometer was held in each hand separately, parallel with the leg and the participant had to squeeze it as hard as possible, after which the score was recorded in kg.

*Standing long jump:* The participant stood feet slightly apart (toes behind a starting line) and jumped forwards as far as possible. Two trails were given and the farthest distance was measured in centimeters from the starting line to the heel of the foot nearest to that line<sup>35</sup>.

*Modified sit-and-reach:* This test measures the flexibility of the lower back and hamstrings by means of a standard box and metre stick<sup>36</sup>. The participant sits with both feet against the standard box and with the hands on top of each other with a straight back against a wall. The distance was measured from the starting line to the tip of the fingertips (cms). The participant was then asked to reach as far as possible and hold the position for three seconds. The distance was measured and deducted from the first measurement.

### **The Previous Day Physical Activity Recall (PDPAR)**

The **Previous Day Physical Activity Recall (PDPAR)**, compiled by Trost<sup>37</sup>, was used to gather data regarding the children's physical activities of the previous day (a 24-hour recall questionnaire) for a weekday and one day during the weekend. According to this information the children's physical activity levels were classified as low (1), moderate (2) or high (3).

## Data analysis

The data were analysed with SAS <sup>38</sup> and Statistica v.7 for Windows <sup>39</sup>. Descriptive statistics (means, standard deviations and maximum and minimum values) summarised the data. One and two-way Analysis of Covariance (ANCOVA) were done with the pre-test, maturation (girls – age of menarche, hair and breast development, and boys - hair and genital development) and physical activity level as covariates. A Tuckey-Kramer multiple comparisons analysis was also performed.

## Results

The attendance of the intervention group that took part in the intervention programme (N=252) was calculated into percentages. These percentages were used to divide the group into three smaller attendance groups (1) = above 70%, (2) = 50-70%, (3) = below 50% for analysis purposes. Table 1, showing the percentages of children classified into each of these groups, indicated that a very small percentage of the learners (n=33, 13.1%) attended the programme regularly (group 1 with attendance above 70%). It is noteworthy that this group mostly consisted of girls (Table 1).

TABLE 1. Characteristics of participants in the different attendance groups (EG 1-3) and the CG: age, gender, biological maturation and percentage stunting of the groups

	EG 1(>70%)	EG 2 (50-70%)	EG 3 (< 50%)	4 (CG)
N (% of group)	33 (13.1%)	56 (22.2%)	163 (64.7%)	66 (100%)
Age	13.9 (SD=1.59)	14.3 (SD=1.29)	15.1 (SD=1.31)	13.9 (SD=1.04)
Gender: Boys/girls	5/28	22/34	89/74	21/45
Tanner Boys (Hair)	2.2	2.9	3.2	2.9
Tanner Boys (Gen)	2.8	2.7	3.0	2.9
Tanner Girls (Hair)	3.0	3.1	3.5	3.3
Tanner Girls (Breast)	2.7	3.1	3.4	3.1
% of Girls who had reached menarche	30.3	39.3	38.7	45.5
Stunted	6 (18.2%)	10 (17.9%)	21 (12.9%)	5 (7.6%)
Gender: Boys/Girls	2/4	4/6	14/7	3/2
Tanner Boys (Hair)	1.0	2.8	3.1	2.3

Tanner Boys (Gen)	1.5	2.6	2.8	2.3
Tanner Girls (Hair)	2.8	2.7	2.9	2.0
Tanner Girls (Breast)	2.3	3.1	3.0	2.5
% of Girls who had reached menarche	25	57.1	75	50
Non-stunted	25 (75.8%)	39 (69.6%)	104 (63.8%)	61 (92.4%)
Gender: Boys/Girls	2/23	16/23	52/52	18/43
Tanner Boys (Hair)	2.5	2.9	3.2	2.9
Tanner Boys (Gen)	3.0	2.6	3.0	2.9
Tanner Girls (Hair)	3.0	3.2	3.5	3.4
Tanner Girls (Breast)	2.8	3.1	3.5	3.2
% of Girls who had reached menarche	37.5	66.7	86.4	67.4

(Gen)= Genitals, EG= Experimental Group, CG= Control Group

Group 4 (N=66) represents the control group (CG). Maturation data are provided in Table 1 as well as the number of boys and girls that are stunted and non-stunted in each of the different attendance groups. From the percentages of stunted and non-stunted girls who had reached menarche it is clear that a much smaller percentage of the stunted girls had reached menarche in each group compared to non-stunted girls. Furthermore, both stunted girls and boys were in lower Tanner stages for breast, pubic hair and genital development in all the attendance groups and the CG. The children with the poorest attendance of the intervention programme (<50%) were also the oldest. The percentages of children that were stunted in the total group were 13.2% (intervention group 14.7% and control group 7.6%), of which 20.7% boys and 11.9% girls (Table 1).

The results of the boys and girls were analysed separately because different maturation variables were used as covariates for boys and girls in the analyses of the data. The results obtained for the girls are discussed first. The effect of stunting and percentage attendance of the intervention programme were analysed by means of an ANCOVA (with groups and stunting as factors, corrected for the covariates namely pre-test values, maturation and habitual physical activity for the difference between the post- and pre-test values) and the results for girls are displayed in Table 2.

For this analysis all the data of the girls in the different attendance and control groups were used. Stunting and attendance groups were used as factors to determine their effect on the different variables. It seems that the different attendance groups had an effect on the PACER test, standing long jump, lean body mass and z-score, while stunting had an effect on the trunk lift among the girls. The interaction between groups and stunting had an effect on the PACER test, hand grip strength, fat percentage and the z-score. This shows that mean differences between the stunted and non-stunted girls follow different patterns for the different groups with regard to the PACER test, hand grip strength, body fat percentage and their z-scores. These variables that were revealed by the ANCOVA were analysed further and the results of the analysis are presented in Table 3, indicating in which attendance groups the differences between the stunted and non-stunted girls occurred.

TABLE 2. Results of a Two-way ANCOVA for post-pre-differences of fitness and body composition variables for girls

Variable	Effect	df1	df2	F	p
PACER test	Groups	3	128	3.62	0.015
PACER test	Groups * stunted	3	128	2.02	0.115
Trunk lift	Stunted	1	138	3.72	0.056
Standing long jump	Groups	3	137	2.72	0.047
Hand grip strength	Groups * stunted	3	138	3.77	0.012
Body fat %	Groups * stunted	2	91	2.72	0.071
Lean body mass	Groups	3	105	2.53	0.061
Height-for-age Z-score	Groups	3	143	3.04	0.031
Height-for-age Z-score	Groups * stunted	3	143	4.17	0.007

Groups= Different attendance groups, Stunted= According to the Z-score (<-2.0), df=degrees of freedom, F=F-value, p=p-value, Group \* stunted= the interaction between exercise attendance group and stunting. Only results with p<0.1 for group and stunting effects and p<0.2 for interaction effects are displayed.

With this analysis the selection of data became smaller and smaller groups were used, thus it is possible that fewer significant differences could be found (Table 3). Of all the variables indicated in Table 2, only the PACER and hand grip strength were indicated to be analysed by means of a one way ANCOVA, in order to determine the effect of stunting. This analysis reported in Table 3 of the PACER test values of the stunted and non-stunted girls in EG 1

(the group with the highest attendance) showed significant differences between the two groups.

TABLE 3. Statistically significant results of a One-way ANCOVA for the post-pre-test differences of girls within attendance groups

Variable	Groups	Effect	df1	df2	F	p	Corrected Means	
							Stunted	Non-stunted
PACER	EG 1	Stunted	1	23	7.50	0.012	5.65	-0.92
Hand grip strength	EG 3	Stunted	1	58	5.43	0.023	7.56	1.45

Groups= Different attendance groups, Stunted= According to the height-for-age Z-score (<-2.0), df=degrees of freedom, F=F-value, p=p-value, Corrected Means= corrected for covariates (differences between post-and pre-tests and also corrected for maturation, pre-test and physical activity)

Descriptive results indicate that the stunted girls showed higher corrected mean difference values in the pre- and post-test scores in the PACER tests than the non-stunted girls (M = -0.92), and it also showed improvement in the stunted group (M = 5.65) compared to a decrease in the non-stunted group. Hand grip strength also showed significant differences between the stunted and non-stunted girls in EG 3. The stunted girls' corrected mean difference values (M = 7.56) were higher than the non-stunted girls (M = 1.45) in this group. From this table (Table 3) it can be concluded that the stunted girls showed the best improvement after participation in the programme in their PACER (aerobic capacity) and hand grip strength (static strength) values.

Further analyses were done by means of a Tuckey-Kramer multiple comparisons (corrected for the pre-test, maturation and habitual physical activity for the difference between the post- and pre-test values) to determine if the different attendance groups differ significantly for the non-stunted groups of girls and the results are reported in Table 4. However, no analyses were done on the stunted girls within the attendance groups, due to very small group sizes.

The results in Table 4 reveal that in the non-stunted group, the sit-and-reach (Left), arm hang and trunk lift showed significant differences between the different attendance groups. Non-stunted girls in EG 2 showed a significant difference in improvement after the

programme in sit-and-reach left (M = 2.09) compared to EG 3 who showed a decrease. Arm hang showed a significantly higher improvement in group 4 (CG) (M = 1.50) compared to EG 1, 2 and 3 where a decrease was indicated. Trunk lift in the non-stunted girls of EG 1 (M = 1.39) showed a significant improvement compared to a decrease in the CG.

TABLE 4. Tuckey-Kramer multiple comparisons for girls between the non-stunted groups

Variable	Stunted group	Group differences	P	Corrected Means
Sit-and-reach –Left	Non-stunted	EG 2 & EG 3	0.047	2.09 & -0.61
Arm hang	Non-stunted	EG 1 & CG 4	0.083	-0.24 & 1.50
		EG 2 & CG 4	0.031	-0.47 & 1.50
		EG 3 & CG 4	0.050	-0.03 & 1.50
Trunk lift	Non-stunted	EG 1 & CG 4	0.033	1.39 & -0.74

Group differences= Different attendance groups, Maturation= According to Tanner, PA= Physical activity level for the week, Stunted= According to the Z-score (<-2.0), Corrected Mean values= corrected for covariates (differences between post-and pre-tests and also corrected for maturation, pre-test and physical activity)

The boys were analysed in a similar way and the results are reported in Tables 5-7.

The results of the effect of stunting and percentage attendance (EG 1-above 70%, EG 2-50-70%, EG 3-below 50%) of the intervention programme were analysed for boys by means of an ANCOVA and reported in Table 5. This analysis showed that attendance groups affected the push-ups, sit-and-reach right and height-for-age z-score values. The interaction between groups and stunting affected the PACER and the sit-and-reach with the right leg. The results indicated that there were differences between the different attendance groups and stunted and non-stunted boys in these variables. The results were analysed further to determine if there were differences between stunted and non-stunted boys in the different attendance groups.

TABLE 5. Results of a Two-way ANCOVA for post-pre-test differences of fitness and body composition variables for boys

Variable	Effect	df1	df2	F	P
PACER	Groups * stunted	3	99	2.75	0.047
Push-up	Groups	3	101	3.47	0.019
Sit-and-reach –Right	Groups	3	101	5.90	0.001
Sit-and-reach –Right	Groups * stunted	3	101	6.65	0.000
Lean body mass	Groups * stunted	3	84	2.06	0.111
Height-for-age Z-score	Stunted	1	100	3.44	0.067
Height-for-age Z-score	Groups	3	100	9.36	<0.0001

Groups = Different attendance groups, Stunted= According to the Z-score (<-2.0), df=degrees of freedom, F=F-value, p=p-value, Group \* stunted= the interaction between these variables

With this analysis the selection of the data became smaller and smaller groups were used, thus fewer significant differences could be found. Of all the variables indicated in Table 5 only the sit-and-reach right and lean body mass could be analysed by means of a One-way ANCOVA to determine the effect of stunting. These results are displayed in Table 6.

From the results in Table 6 the sit-and-reach right and lean body mass showed differences, although not significant on a 95% level of significance ( $p < 0.09$ ) between the stunted and non-stunted boys in group 2. Lean body mass had the highest value in the non-stunted group ( $M = 3.78$ , stunted boys  $M = 1.03$ ) and the sit-and-reach to the right values of the stunted boys ( $M = 3.84$ ) indicated a better result than the non-stunted boys ( $M = -2.35$ ) who showed a deterioration. This shows that there were significant differences between stunted and non-stunted boys in some of the variables in the different groups. From the results it can be seen that the stunted boys showed improvement in their sit-and-reach (Right), whereas the non-stunted and stunted boys showed improvement in lean body mass, although to a higher degree, but not significantly in the non-stunted group. Very few stunted boys were in group 1, which consisted mainly of girls, which might explain why no differences were found in this group.

TABLE 6. Statistical significant results of a One-way ANCOVA for the post-pre-test differences of boys within attendance groups

Variable	Groups	Effect	df1	df2	F	p	Corrected Means	
							Stunted	Non-stunted
Sit-and-reach –R	EG 2	Stunted	1	17	3.15	0.094	3.84	-2.35
Lean body mass	EG 2	Stunted	1	15	3.88	0.068	1.03	3.78

Groups= Different attendance groups, Stunted= According to the Z-score (<-2.0), df= degrees of freedom, F=F-value, p=p-value, Corrected Mean values= corrected for covariates (differences between post-and pre-tests and also corrected for maturation, pre-test and physical activity)

Further analyses were done by means of a Tuckey-Kramer multiple comparisons (corrected for the pre-test, maturation and habitual physical activity for the difference between the post- and pre-test values) to determine if the different attendance groups differed significantly for the non-stunted groups of boys, and the results are reported in Table 7. No analyses were done on the stunted boys within the attendance groups, due to very small group sizes.

From Table 7 it seems that CG 4 (M = 5.10) of the non-stunted boys had the biggest improvement in push-ups. For standing long jump the only significant differences between the groups were between EG 3 and CG 4 and it seems that EG 3 (M = 18.38) had the biggest improvement. For the z-score among the non-stunted boys it seems that there were only significant differences between EG 2, 3 and CG 4, and EG 3 (M = -0.02) had the biggest improvement. The non-stunted boys improved in push-ups, standing long jump and z-score.

TABLE 7. Tuckey-Kramer multiple comparisons for boys between the non-stunted groups

Variable	Stunted groups	Group differences	P	M
Push-up	Non-stunted	EG 2 & CG 4	0.043	0.62 & 5.10
		EG 3 & CG 4	0.016	0.95 & 5.10
Standing long jump	Non-stunted	EG 3 & CG 4	0.028	18.38 & 0.32
Z-score	Non-stunted	EG 2 & CG 4	0.056	-0.08 & -0.52
		EG 3 & CG 4	0.004	-0.02 & -0.52

Groups= Different attendance groups, Maturation= According to Tanner, PA= Physical activity level for the week, Stunted= According to the Z-score (<-2.0)

## Discussion

The aim of this study was to determine if changes in PF were different among stunted and non-stunted children after participation in a PA intervention programme. Only few research findings could be found regarding the physical fitness status of stunted children<sup>12, 14</sup>. No studies which reported the influence of a PA programme on stunting could however be traced to compare the results with this study. From the results of this study it seems that different PF variables were affected among adolescent boys and girls and among stunted and non-stunted children after participation in a PA intervention programme. Differences in attendance of the programme also affected the PF variables and stunted and non-stunted adolescents differently. From the results it seems that the stunted girl's aerobic capacity and hand grip strength were the most positively affected by the PA intervention programme, while trunk and hip flexibility (on the left side) improved among the non-stunted girls after participation in the programme. It is however clear that the highest percentage of attendance of the programme benefited the aerobic capacity of stunted girls the most. It can therefore be concluded that participation in the programme had a different influence on the physical fitness of stunted and non-stunted girls. From a health perspective, the improvement in aerobic capacity and hand grip strength among the stunted girls who regularly participated in the physical activity programme, is however positive, as poorer levels of aerobic capacity and strength were reported among stunted children by Bar - Or<sup>12</sup> and Monyeki<sup>14</sup>.

As for the stunted boys, only sit-and-reach (right) in group 2 showed improvement after participating in the programme. No research findings could, however, be found to compare this result with. Non-stunted boys benefited in push-ups, standing long jump and their height-for-age z-score. These benefits occurred in group 3 in their standing long jump and height-for-age z-score and in the push ups of group 4.

It is reported that stunting might deteriorate during the growing years. Friedman<sup>20</sup> indicated in this regard that the stunting of children under the age of 13 years progressed over a two year period, while Lwambo<sup>40</sup> found that 7-18-year-old Tanzanian children's z-score for height-for-age for both boys and girls decreased significantly between 7-12 years. After 12 years of age, girls' height-for-age z-score showed a marked upturn, whilst z-scores for boys continued to decrease until 16 years when a slight upturn was observed. Bénéfice<sup>41</sup> found that stunted Senegalese girls showed catch-up growth in body weight and subcutaneous fat mass during puberty, but no catch-up in stature. As malnutrition is associated with a lower capacity to do hard physical work and with poorer levels of physical fitness among mildly or severely affected children, it can be concluded that the physical fitness of stunted children might also deteriorate with increasing age, which highlight the importance of physical activity intervention.

In the study of Bénéfice<sup>41</sup> non-stunted girls showed a trend towards earlier maturation than stunted girls. This tendency was confirmed by our study, where all the stunted girls in the groups had lower levels of maturity compared to the non-stunted girls. The higher maturation level of the non-stunted girls (in group 1) might therefore have had an effect on their aerobic capacity and the improvement thereof, as higher maturation in girls (which formed the biggest percentage of group 1) is associated with higher fat mass which has a detrimental influence on aerobic capacity<sup>42</sup>. There was, however, a statistical adjustment for the effect of level of maturation, which ruled out this possibility, especially among stunted girls who exercised regularly, as this positive effect was only evident among the stunted girls who exercised regularly. The fat percentage of the non-stunted girls was 26.85% during the pre-test compared to 25.10% of the stunted group.

To conclude, it seems that the boys and girls, stunted and non-stunted, as well as the different attendance groups benefited from participating in the physical activity programme. Very few significant differences were, however, found because of the small groups – gender, stunted and attendance groups - into which the children were divided. Stunted and non-stunted adolescents each showed improvement in different physical fitness and body

composition components, but it can be concluded that the stunted adolescents showed better improvement in aerobic capacity and hand-grip-strength among girls, while lean body mass and sit-and-reach on the right side benefited in stunted boys.

Although the results provided important knowledge regarding the effect of PA intervention on stunted children, the research findings should be interpreted against the limitations of the study. The biggest limitation was the small groups of stunted adolescents that were identified in each of the attendance groups. The poor attendance of the programme by the group as a whole was another confounding factor that was beyond the control of the researchers. Furthermore, the control group selection was based on the view of the State Health Department that they also had a high percentage of stunted children. In reality the research indicated that they were not a true control group for the intervention school (only 7.6% stunted children compared to 14.7% in the intervention group) which was another limiting factor, especially for comparison purposes. The fact that the school insisted that all the children in Grade 8 should participate in the research programme limited the opportunity to select only the stunted children and compare them with age-matched controls of non-stunted children, also participating in the programme, which was a more desirable research procedure and from which better results might have been obtained. However, the research still indicates that this is an area that might need further research as PA intervention might be valuable for the health of stunted children. To prevent this in other studies more care must be given to the selection process of the learners. It can also be recommended that the control group and the intervention group must have the same sample size.

#### Acknowledgement

Our sincere gratitude to the National Research Foundation (NRF) for the financial grant received for completing the research, and to all the role players in the multi-disciplinary PLAY research project for their contributions.

## Reference list

- 1 Emiola LM, Talabi AE & Ogunsakin EA. The effect of activity level on the fitness and health status of primary school children. *Afri J Phys, Health Education, Rec Dance* 2002; 8:205-218.
- 2 Pate RR, Trost SG, Dowda M et al. Tracking of physical activity, physical inactivity and health-related physical fitness in rural youth. *Pediatr Exerc Sci* 1999; 11:364-376.
- 3 Neumark-Sztainer D, Story M, Hannan PJ, Tharp T & Rex J. Factors associated with changes in physical activity: a Cohort study of inactive adolescent girls. *Arch Pediatr Adolesc Med* 2003; 157:803-810.
- 4 Matton I, Thomis M, Wijndaele K, Duvigneaud et al. Tracking of physical fitness and physical activity from youth to adulthood in females. *Med Sci Sport Exerc* 2006; 38:1114-1120.
- 5 Marshall SJ, Sarkin JA, Sallis JF & Mckenzie TL. Tracking of health-related fitness components in youth ages 9 to 12. *Med Sci Sport Exerc* 1998; 30:910-916.
- 6 Beets MW & Pitetti KH. One-mile run/walk and body mass index of an ethnically diverse sample of youth. *Med Sci Sport Exerc* 2004; 36:1796-1803.
- 7 Kemper HCG, Twisk JWR, Koppes LLJ, Van Mechelen W & Post GB. A 15-year physical activity pattern is positively related to aerobic fitness in young males and females (13-27 years). *Eur J Appl Physiol* 2001; 84:395-402.
- 8 Gutin B, Yin Z, Humphries MC & Barbeau P. Relations of moderate and vigorous physical activity to fitness and fatness in adolescents. *Am J Clin Nutr* 2005; 81:746-750.
- 9 Chan EWC, Au EYM, Chan BHT, Kwan MKM, Yiu PYP & Yeung EW. Relations among physical activity, physical fitness, and self-perceived fitness in Hong Kong adolescents. *Percept Mot Skills* 2003; 96:787-797.

- 10 Engelbrecht C. Die verband tussen fisieke aktiwiteit en fisieke fiksheid van 13- tot 15-jarige dogters in die Noordwes provinsie. Potchefstroom : PU vir CHO. (Verhandeling – M.A.) 2001; 103.
- 11 Wildschutt PJ. The effect of accumulative physical activity on the fitness and health status of rural school children : University of the Western Cape. (Thesis – M.A.) 2005; 176.
- 12 Bar-Or O, Foreyt J, Bouchard C, et al. Physical activity, genetic, and nutritional considerations in childhood weight management. *Med Sci Sport Exerc* 1998; 30:2-10.
- 13 Ibrahim SA, Abdel-Maksoud AM, Samy MA, Mattar MK, Sarhan AA & Hassan HA. Bone mineral density and bone markers among stunted Egyptian adolescents. *J Nutr Envir Med* 2003; 13:93-101.
- 14 Monyeki KD, Monyeki MA, Toriola AL et al. Somatic characteristics and cardiovascular function in stunted rural South African girls aged 8 to 14 years: Ellisras longitudinal growth and health study. *African Journal for Physical, Health Education, Recreation and Dance* 2005;11:249-268.
- 15 Cameron N, Kgamphe JS, Leschner KF & Farrant PJ. Urban-rural differences in the growth of South African black children. *Ann Hum Biol* 1992; 19:23-33.
- 16 Mantsena M, Monyeki KD, Monyeki MA, Brits JS, Toriola AL & Kangolle, ACT. Body composition of normal and malnourished rural South African children aged 6-13 years: Ellisras longitudinal study. *African Journal for Physical, Health Education, Recreation and Dance* 2003; 9:225-237.
- 17 Cameron N, Gordon-Larson P & Wrchota EM. Longitudinal analysis of adolescent growth in height, fatness, and fat patterning in rural South African black children. *Am J Phys Anthropol* 1994; 93:307-321.
- 18 Kruger HS, Margetts BM & Vorster HH. Evidence of relatively greater subcutaneous fat deposition in stunted girls in the North-West province, South Africa, as compared with non-stunted girls. *Nutrition* 2004; 20:564-569.

- 19 Mamabolo RL, Kruger HS, Lennox A et al. Habitual physical activity and body composition of black township adolescents residing in the North-West province, South Africa. *Public Health Nutr* 2007;10(4):1047-1056.
- 20 Friedman JF, Phillips-Howard PA & Mirel LB. Progression of stunting and its predictors among school-aged children in western Kenya. *Eur J of Clin Nutr* 2005; 59:914-922.
- 21 Lunn PG. Invited commentary: Growth retardation and stunting of children in developing countries. *Br J Nutr* 2002; 88:109-110.
- 22 Walsh CM, Dannhauser A & Joubert G. The impact of a nutrition education programme on the anthropometric nutritional status of low-income children in South Africa. *Public Health Nutr* 2002; 5:3-9.
- 23 Winnick JP. *Adapted physical education and sport*. Champaign, Ill : Human Kinetics, 2005; 573.
- 24 Actical Software Instruction Manual. Mini Mitter Company. Inc. Bend OR USA. Actical Physical Activity Monitoring System Software V.2.0
- 25 BOD POD – Customer training. Body composition tracking system. Life Measurement, Inc, 2003.
- 26 Dewit O, Fuller NJ, Fewtrell MS, Elia M & Wells JCK. Whole body air displacement plethysmography compared with hydrodensitometry for body composition analysis. *Arch Dis Child* 2000; 82:159-164.
- 27 Dempster P & Aitkens S. A new air displacement method for the determination of human body composition. *Med Sci Sports Exerc* 1995; 27:1692-1697.
- 28 Mole PA. Evaluation of a new air displacement plethysmograph for measuring human body composition. *Med Sci Sport Exerc* 1995; 27:1686-1691.
- 29 Siri WE. Body composition from fluid spaces and density: analysis of methods. *Nutrition* 1993; 9:480-492.

- 30 Norton K & Olds T. *Anthropometrica. a textbook of body measurement for sports and health courses*. Sydney: University of New South Wales Press, 1996. 411.
- 31 Faulkner RA. Maturation. In: Docherty D, ed. *Measurement in pediatric exercise science*. Champaign, Ill.: Human Kinetics, 1996; 129-155.
- 32 Puyau MR, Adolph AL, Vohra FA & Butte NF. Validation and calibration of physical activity monitors in children. *Obes Res* 2002; 10:150–157.
- 33 Ainsworth B, Haskell WL & Leon AS. Compendium of physical activities: classification of energy costs of human physical activities. *Med Sci Sport Exerc* 1993; 25:71– 80.
- 34 Meredith MD & Welk GJ. *Fitnessgram; test administration manual*. Dallas : Human Kinetics, 1999; 121.
- 35 Wood R. Fitness testing. [Web:] [http://fitness\\_testing.8m.com/anaerob.htm](http://fitness_testing.8m.com/anaerob.htm). 1997.
- 36 Docherty D. *Measurement in pediatric exercise science*. Canada : Human Kinetics, 1996; 11.
- 37 TROST, S.G., WARD, D.S., MCGRAW, B. & PATE, R.R. Validity of the previous day physical activity recall in fifth-grade children. *Pediatr Exerc Sci*, 1999; 11:341-348.
- 38 SAS Institute Inc. *The SAS System for Windows Release 9.1 TS Level 1M0* Copyright© 2002-2003 by SAS Institute Inc., Cary, NC, USA.
- 39 STATSOFT. *Statistica for Windows. Release 5.5: general conversions and statistics*. Tulsa, Oklahoma : StatSoft, 2004.
- 40 Lwambo NJS, Brooker S, Siza JE, Bundy DAP & Guyatt H. Age patterns in stunting and anaemia in African school children: a cross-sectional study in Tanzania. *Eur J Clin Nutr* 2000; 54:36-40.

41 Bénédicte E, Garnier D, Simondon KB & Malina RM. Relationship between stunting in infancy and growth and fat distribution during adolescence in Senegalese girls. *Eur J Clin Nutr* 2001; 55:50-58.

42 Malina RM, Bouchard C & Bar-Or O. Growth, maturation and physical activity. Champaign, Ill : Human Kinetics, 2004; 712.

# CHAPTER 7

## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS



## 7.1 Summary

Literature indicates that children and adolescents are becoming more inactive and their choices of activities are becoming more sedentary too, thus making them more vulnerable to health risk factors. Adolescents from disadvantaged communities often do not have the opportunity to participate in sport and physical activities, because they have to spend a great deal of their time performing income-generating activities and other house duties. Other barriers inhibiting them from being physically active are a lack of sports facilities, domestic responsibilities, lack of knowledge and time constraints. Stunting and wasting are also associated with low socio-economic environments and research indicates that it can influence the activity behaviour of adolescents from disadvantaged communities.

The first aim of this study was to determine the physical activity and physical fitness status of 15-year-old adolescents who live in a low socio-economic environment and secondly to establish the factors that would be seen as barriers and motivators for boys and girls living in such environments to improve their physical activity and participation in sport. Thirdly, the study aimed to determine the physical activity levels and choices during the week and weekend of these 15-year-old adolescent learners and the effect of a PAIP on their physical activity levels and choices. The last aim of this study was to determine the effect of the PAIP on the physical fitness of stunted adolescent children in this low socio-economic environment. *Chapter 1* describes the problem, aims and hypodissertation of the study.

*Chapter 2* consists of a literature review, where physical fitness, physical activity and other factors influencing and related to PA and PF patterns are discussed. In this review specific attention was focused on the factors, such as barriers and motivators that influence PA and PF among adolescents, and especially among those living in low income areas. Literature regarding the content and successes of intervention programmes that focus on PA among adolescents was also analysed and discussed. The literature study has revealed that PA and PF play an important role in children and adolescents' general health and well-being. It has also revealed that PA decreases with increasing age and that adolescents choose to participate in more sedentary activities such as watching television. Boys tend to be more physically active than girls and girls prefer more sedentary activities like watching television. Barriers that hinder participation in physical activity among adolescents include lack of time

and facilities, too much school work and lack of money. Adolescents living in low socio-economic environments, experience additional but also different barriers to children from higher socio-economic environments such as lack of parental support and child care responsibilities. The physical activity intervention studies found in the literature were mainly conducted on children and adults, with few physical activity programmes focused on adolescents. It was also found that stunting was a factor that affected the PF of low SES children, but no studies were found that focused on physical activity and physical fitness intervention for such children.

*Chapter 3* is presented in article format and was approved for submission to the South African Journal for Research in Sport, Physical Education and Recreation. The aim of this study was, firstly, to determine the physical fitness and physical activity status of 15-year-old adolescent learners from a previously disadvantaged community in the North-West Province of South Africa, and secondly, to determine relationships between physical fitness, physical activity and the distances the children walked to school. Two schools were selected for the testing, School 1 (252 learners, 116 boys and 136 girls) and School 2 (66 learners, 21 boys and 45 girls). The PDPAR questionnaire was used to determine the learners' physical activity levels, and their TV-viewing hours, while the Fitnessgram measuring instrument was used to determine their physical fitness level in cardiovascular fitness, muscular endurance, strength and flexibility. Body size and body composition which are part of this test battery were analysed by means of anthropometric variables. Handgrip strength, leg strength (standing long jump) and flexibility (modified sit-and-reach) were additionally tested. The mode of travel was determined by means of a demographic questionnaire. Descriptive statistics, t-testing and correlational analysis were used to analyse the data. Boys and girls in School 1 and boys in School 2 were found to be moderately active, while the girls in School 2 showed a lower PA level. Longer commuting distances and higher mean physical fitness values were found in School 1. More hours of television viewing were found among boys and girls in School 2, and it was found that the physical activity status of learners was influenced by TV viewing and the distances they had to walk to school. Poor strength levels, falling outside the HFZ and showing relationships with other PF components were also indicated in the group. Boys of School 1 were significantly older and taller than those of School 2, although the boys of School 2 had bigger sub-scapular and triceps skin folds as well as a higher percentage body fat. Girls in School 2 showed significantly higher sub-scapular and triceps skin folds as well as percentage body fat, than girls in School 1. Television viewing and commuting distances to

school appeared to have a moderate influence on the moderate to low PA levels of the group, and physical activity showed a relationship with higher fitness values. From the results, physical activity intervention is recommended for children from low socio-economic environments with specific focus on strength improvement.

*Chapter 4* contains an article regarding the factors that would be seen as barriers, but also those serving as motivators to boys and girls living in a previously disadvantaged community in order to improve their physical activity and participation in sport, and to determine their perception of their own physical activity level. The article was submitted to the African Journal for Physical Health Education, Recreation and Dance. Two schools were involved in the research, School 1 (N = 252 learners, 116 boys and 136 girls, mean age 14.8 years) and School 2 (N = 66 learners, 21 boys and 45 girls, mean age 13.9 years). A questionnaire from Rowland (1990) was used to gather information, with added questions from the questionnaire of Meredith and Welk (1999). A demographic questionnaire obtained information on mode of travel to and from school and sports participation patterns. Statistica for windows was used to analyse the data by means of descriptive statistics, frequency and rank ordering. The results showed that most of these learners walked to school and participated in sports, which were mostly soccer and netball, although differences in sport participation patterns were found between boys and girls. The barriers they experienced differed to an extent from children living in better circumstances and were mostly out of their control, while differences were also found between the barriers that boys and girls experienced. The main barriers that were indicated were too much homework, lack of money, home and family responsibilities, lack of facilities and coaches, watching TV and time constraints. Factors that were indicated as possible motivators to increase participation were having parents that understood the value of PA and encouraged them, friends that participated with them and reminders of the health advantages of PA. The results also revealed that after participation in the physical activity programme the learners' perceptions of PA changed and they had a better knowledge of the intensity of physical activity. It was concluded from the results that these factors should be taken into consideration when planning and implementing physical activity programmes among children living in poor socio-economic environments.

*Chapter 5* displays the results of an article submitted to the Journal of Teaching in Physical Education on the findings regarding the physical activity choices of adolescent children from a previously disadvantaged community during the week and weekend and the effect of

a physical activity intervention on their physical activity choices and levels and aerobic endurance. Two hundred and fifty-two (N = 252) black Grade 8 learners (116 boys and 136 girls) with a mean age of 14.8 years ( $\pm 1.43$ ) formed the intervention group while N = 66 Grade 8 learners (21 boys and 45 girls with a mean age of 13.9 ( $\pm 1.04$ )) formed the control group. The activities that the children engaged in were arranged by order of highest occurrence and average number of half hour intervals spent on that activity. Descriptive statistics and Tuckey post hoc analysis were used to analyse the data. The results revealed that the average time spent on activities practiced in the intervention programme had a very insignificant effect on their physical activity preferences after completion of the programme, although some effect was evident on soccer and netball participation. The group with the highest attendance percentage of the intervention programme (>70%) seemed to sustain their aerobic capacity the best. The results indicated that physical activity intervention (as presented in this study) will not necessarily increase PA patterns after completing such a programme.

*Chapter 6* contains an article presented to the *Annals of Tropical Prediactics*. This study aimed to determine if changes in physical fitness (PF) were different among stunted and non-stunted children after participation in a physical activity (PA) intervention programme of six months. Two hundred and fifty-two learners categorised into stunted (14.7%) and non-stunted (66.7%) learners and in three different attendance groups (>70%, 50-70%, <50%) from an intervention school participated in a PAIP and their results were compared to a control group of 66 learners, stunted (7.6%) and non-stunted (92.4%), from another school. One and two-way Analysis of Covariance (ANCOVA) and a Tuckey-Kramer multiple comparisons were done to analyse the data for boys and girls separately because different co-variables were used for the different sexes. The results indicated that only the stunted girls who participated regularly (>70%) showed improvement in aerobic capacity and hand grip strength while lean body mass and sit-and-reach (right) improved more in stunted boys. Although few differences were found between stunted and non-stunted learners, the results did indicate that physical activity intervention might be of benefit to the PF of stunted learners.

## 7.2 Conclusions

The conclusions of this study are based on the hypothesis and the results of the study.

*HYPOTHESIS 1: Fifteen-year-old adolescents in low socio-economic environments manifest moderate to high physical activity levels and their physical fitness will be in the HFZ.*

The results revealed no high PA levels although moderate physical activity levels were found among all the adolescents, except for the girls in School 2, who had a low PA level. The hypothesis regarding PA can therefore be accepted for boys and girls in School 1 and boys in School 2 but only partially for girls in school 2.

The PF variables that fell within the HFZ were aerobic fitness, hip and trunk flexibility and body composition of learners in School 1 and for learners in School 2 aerobic fitness hip and trunk, flexibility, pull-ups and body composition, while all the strength values fell in the at risk category (chin-ups, arm hang, sit-ups and push-ups). The hypothesis can therefore only be accepted for aerobic fitness, flexibility and body composition of School 1 and 2 that fell in the HFZ but are rejected for strength in both Schools.

*HYPOTHESIS 2: There are several barriers that will hinder 15-year-old adolescents in disadvantaged communities from demonstrating adequate health-promoting physical activity and physical fitness, and they will have a poor perception of their level of physical activity.*

Although the findings of this research indicated that, as a group, they were reasonably active and regularly participated in sport especially soccer and netball, barriers to being more active which are directly related to the living circumstances of the group were experienced by them. Too much homework, home and family duties, lack of sports facilities and coaches, lack of funds and too little time were the main factors inhibiting the learners' PA and participation in sport. The results revealed that the most important factors which would encourage both boys and girls to be physically active were encouragement from parents, friends who would exercise with them and being reminded of the health benefits of PA. Prior to the programme, the great majority of learners perceived themselves as being more active than their perception was after exposure to the programme. The results

revealed that after exposure to the exercise programme, the experimental group's knowledge of the intensity of PA participation was expanded, which contributed to the change in their perception. This hypothesis can therefore be accepted.

*HYPOTHESIS 3: A PAIP will improve PA levels and active physical activity choices and aerobic capacity of 15-year-old adolescents in disadvantaged communities.*

Only 33 children out of 252 who were mainly girls and also the youngest and the less biologically mature when compared to the other groups, attended the intervention programme on a regular basis (70% attendance and more). Time spent on sedentary activity choices, like TV viewing, increased in both schools (intervention and control) during the week and the weekend after completion of the programme, a pattern which was also seen in the group of 33 adolescents with the highest attendance of the PA programme. However, this group's energy expenditure, physical activity level and aerobic capacity stayed the same compared to the other groups where tendencies of lower physical activity and aerobic capacity were noted after completion of the programme. More time was spent on sports skills, especially soccer and netball, by children in the intervention school, after participating in the programme (regardless of their attendance to the programme), from which it can be concluded that the part of the programme where such skills were practiced might have influenced these active choices. Only tendencies of a shift in PA patterns were seen. This hypothesis can therefore only be accepted partially for physical activity choices as their TV viewing, which is a passive activity choice, increased. Regarding improvement of the physical activity level and aerobic capacity after participation in the PA programme, no significant improvement was seen. The most positive result was that it could be sustained in group 1 (70% attendance and above). The hypothesis is therefore rejected because no significant improvement was established in physical activity, physical activity patterns and aerobic capacity.

*HYPOTHESIS 4: Participation in a PAIP will improve the physical fitness and stunting values of stunted adolescents in disadvantaged communities.*

For the analysis of this hypothesis the results were analysed by means of group (attendance), gender and stunted and non-stunted. The results indicated that only stunted girls with the highest attendance of the programme improved significantly in aerobic capacity and hand grip strength, while lean body mass and sit-and-reach (right) in stunted

boys improved significantly as a result of the programme. No significant improvement was found regarding the stunting of the group. Therefore the hypothesis can only be accepted partially for PF as only some aspects of PF did improve as a result of the physical intervention but is rejected for stuntedness as their stuntedness did not improve.

## **7.3 Recommendations**

- 7.3.1 From the results of this study it seems that the PA intervention programme that was developed for this study could be implemented in schools and communities in disadvantaged areas to improve the physical activity and physical fitness status of adolescents. Specific attention should, however, be given to improve shortcomings in the content of the programme, especially improvement of strength. It is also recommended that more sports-related skills and abilities could be included in the programme to improve PF as these kinds of activities seem to interest all the children (boys and girls) the most.
- 7.3.2 The results of the study revealed that the group with the highest percentage attendance was girls. The biggest percentage of the programme was based on aerobic activities which are mostly engaged in by girls. It is therefore recommended that adolescent boys and girls should be separated during the presentation of such a physical activity programme because their activity interests vary according to their age and maturation stage. The content of the programme should be based on their particular interests at that stage in order to improve and sustain participation. It is also recommended that children from a younger age could also be involved in such programmes so that a healthy lifestyle by means of physical activity and knowledge of what sufficient physical activity entails can be implemented earlier in life.
- 7.3.3 The results of the study revealed that adolescents in low socio-economic environments had homework and family responsibilities after school, making it particularly difficult to participate in PA programmes after school as was evident from the low attendance rates of the learners, but which were also indicated as reasons for low attendance. It is therefore recommended that such physical activity intervention programmes should be implemented during school hours, where all the children can be exposed to PA and also be educated on the benefits of being

physically active and fit. Teachers should also be educated on the importance and benefits of such activity programmes for learners, in order to motivate them to make time and become involved in such programmes during school hours. It is also recommended that efforts should be made to educate the parents of children from low socio-economic environments on the importance of participation in physical activity so they cannot only motivate their children to be active, but also understand the importance of physical activity in the development and health of their children.

7.3.4 The results of this study showed that physical activity had a positive effect on stunting, therefore more research should be done in this regard. More physical activity programmes should be presented to stunted learners to find the ideal programme to help improve their physical activity, physical fitness and it may also help to improve their stuntedness.

Although this study was thoroughly planned, some limitations were evident and should be addressed if future similar studies are planned. The following recommendations are made in this regard:

7.3.5 Firstly, the results were influenced by the small percentage of learners that participated regularly in the programme, something that was beyond the control of the researchers. It is therefore recommended that similar research studies be conducted during school hours in order to prevent this compliance problem.

7.3.6 A further shortcoming was that the learners that participated regularly were mostly girls, which might be related to the content of the programme which included a high percentage of aerobic dance-related activities. It is therefore recommended that more sports skills activities (which might also motivate boys to participate on a regular basis) should be included in similar programmes in the future. It is also recommended that girls and boys be separated when such programmes are conducted.

7.3.7 There were also very small numbers of stunted learners in the groups that were analysed, making the analysis and generalising of these results difficult, and generalising impossible. However, the results indicated a positive relationship between physical activity and stunting, and further research in this regard is

therefore recommended. Researchers should however, make sure that they identify and select groups of children that include a sufficient number of these children.

7.3.8 Although this study focused on Grade 8 learners, a variation of different aged learners were found in this grade. It is recommended that the researchers should be aware of this tendency in disadvantaged communities and that they should select their participants according to their age and not their grade, as this will improve data analysis and interpretation.

# APPENDIXES



# **APPENDIX A**

## **Informed consent documents**

## PLAY PROJECT: INFORMATION ON THE STUDY

**THE PROJECT HAS BEEN APPROVED BY THE ETHICS COMMITTEE OF THE NORTH-WEST UNIVERSITY (Potchefstroom Campus).**

### **I CONFIRM THAT:**

It has been explained to me, that:

1. The purpose of the research study is to collect information on growth and activity among Grade 8 school children in Seiphemelo Secondary School, North-West Province.
2. I have been told that the researchers will measure me. The participant will be weighed and his/her height as well as circumferences and skinfolds of his/her arm will be measured without causing any pain to the child. For those measurements boys and girls in separate groups will be asked to undress in privacy of a class-room, because some measurements must be taken with the children dressed in underwear only, or a light shirt and pants/skirt. The researchers will also ask me to indicate my own level of physical maturation from pictures. The different age groups will be measured separately. The researchers and fieldworkers will work in a professional way, so as not to embarrass the children.
3. I will also be measured in an instrument, called the BOD POD to measure amount of muscle, bone and fat. These measurements will be done at the North-West University and children will be transported to the laboratory and back.
4. Fitness testing will be done.
5. Blood samples will be taken during basal and final measurements. Blood will be collected by qualified personnel using a thin needle (20ml blood per each sample) to minimise pain and discomfort. Blood samples will not be tested for HIV.
6. The measurements will be done at the beginning and end of the study. After the first measurements, an activity programme, based on fun games for children will be presented for three days per week at the school. The programme will run from about March to September during the school terms. The purpose of the measurements at the end of the study is to see if the participants improve physically after the activity programme. On at least one day I will be asked to wear a little measuring instrument on a waistband to measure my physical activity. The instrument cannot harm me in any way, all it does is to measure movement.
7. The researchers will ask me about my home environment, the food that I usually eat and activities that I do. None of these questions will be to see if I am clever, or know correct answers. I can just tell them what I usually do.
8. Guidelines for appropriate, culture sensitive, practical and sustainable intervention programmes for children will be developed.
9. The information I will give shall be kept confidential, only to be used anonymously for making known the findings to other scientists.
10. It was also clearly explained to me that I can refuse to participate in this research study or I can stop answering the questions at any time during the interviews, or I can refuse to give a blood sample if it hurts.

The information in this consent form was explained to me by \_\_\_\_\_ (name of interviewer) in \_\_\_\_\_ (language) and I confirm that I have a good command of this language and understood the explanations, OR it was translated to me by \_\_\_\_\_ (Name of translator) in my language \_\_\_\_\_. I was also given the opportunity to ask questions on things I did not understand clearly.

**I, the participant (child) hereby agree voluntarily to take part in this research survey.**

Signed/confirmed at \_\_\_\_\_ on \_\_\_\_\_ 2005

Witness \_\_\_\_\_

Representative of participant (parent/guardian) \_\_\_\_\_

## **PLAY PROJECT: INFORMATION ON THE STUDY**

**THE PROJECT HAS BEEN APPROVED BY THE ETHICS COMMITTEE OF THE NORTH-WEST UNIVERSITY (Potchefstroom Campus), project number 04M01**

**I CONFIRM THAT:**

It has been explained to me, that:

11. The purpose of the research study is to collect information on growth and activity among Grade 8 school children in Boitshoko Secondary School, North-West Province.
12. I have been told that the researchers will measure me. The participant will be weighed and his/her height as well as circumferences and skinfolds of his/her arm will be measured without causing any pain to the child. For those measurements boys and girls in separate groups will be asked to undress in the privacy of a class-room, because some measurements must be taken with the children dressed in underwear only, or a light shirt and pants/skirt. The researchers will also ask me to indicate my own level of physical maturation from pictures. The different age groups will be measured separately. The researchers and fieldworkers will work in a professional way, so as not to embarrass the children.
13. Fitness testing will be done and blood pressure will be tested.
14. The measurements will be done twice, in April and November, to assess growth.
15. The researchers will ask me about my home environment, the food that I usually eat and activities that I do. None of these questions will be to see if I am clever, or know correct answers. I can just tell them what I usually do.
16. Guidelines for appropriate, culture sensitive, practical and sustainable intervention programmes for children will be developed.
17. The information I will give shall be kept confidential, only to be used anonymously for making known the findings to other scientists.
18. It was also clearly explained to me that I can refuse to participate in this research study or I can stop answering the questions at any time during the interviews.

The information in this consent form was explained to me by Mrs Susan Legoete (interviewer) in \_\_\_\_\_ (language) and I confirm that I have a good command in this language and understood the explanations, OR it was translated to me by \_\_\_\_\_ (Name of translator) in my language \_\_\_\_\_. I was also given the opportunity to ask questions on things I did not understand clearly.

**I, the participant (child) hereby agree voluntarily to take part in this research survey.**

Signed/confirmed \_\_\_\_\_ at \_\_\_\_\_ on \_\_\_\_\_ 2004

Witness \_\_\_\_\_

Representative of participant (parent/guardian) \_\_\_\_\_

# **APPENDIX B**

## **Physical activity questionnaire**

# PHYSICAL ACTIVITY QUESTIONNAIRE

<b>Name:</b>	<b>Gender:</b>	<b>M</b>	<b>F</b>	<b>Age:</b>
<b>Subject number:</b>				

**This question asks you about the transport system you use to school and the time it takes from where you stay to arrive at the school.**

What type of transport do you use to school? **(Circle only one answer)**

- |                                |                |                      |
|--------------------------------|----------------|----------------------|
| a. Walk                        | Time it takes: | Distance/Area:.....  |
| b. Public transport (taxi/bus) | Time it takes: | Distance/area:.....  |
| c. Car                         | Time it takes: | Distance:/area:..... |
| d. Bicycle                     | Time it takes: | Distance:/area:..... |
| e. Other                       | Time it takes: | Distance:/area:..... |

**1. DURING THE PAST 3 MONTHS, HOW WOULD YOU BEST DESCRIBE YOUR LEVEL OF PHYSICAL ACTIVITY (CIRCLE LETTER)**

- A. Inactive.** Watch television, read, or do homework after school, ride to school, no sports activities after school hours.
- B. Occasionally active.** Prefer sedentary (mostly in resting position) activities, but sometimes play outside.
- C. Moderately active.** Take opportunities to become involved in physical activity when available and enjoy it.
- D. Active.** Take initiative to participate in physical exercise and prefer this to sedentary activities. At least three times a week involved in vigorous exercise.
- E. Very active.** Participate regularly in sport after school hours, use great deal of energy. Dislike sedentary activities.

**2. HOW WOULD YOU COMPARE YOUR PHYSICAL ACTIVITY WITH THAT OF YOUR FRIENDS?**

- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>1. Equally active</li> <li>2. More active</li> </ul> | <ul style="list-style-type: none"> <li>3. Less active</li> </ul> |
|---|--|

**3. DURING THE LAST 6 MONTHS WERE YOU INVOLVED IN AN ORGANISED SPORT OR EXERCISE PROGRAMME (SUCH AS SOCCER, DANCING CLASSES, NETBALL, BASKETBALL) OUTSIDE OF REGULAR PHYSICAL EDUCATION CLASSES?**

- 1. Yes Describe
- 2. No

**4. DURING THE LAST 6 MONTHS WERE YOU INVOLVED IN REGULAR (2 TO 3 TIMES PER WEEK) ATHLETIC TRAINING (SUCH AS RUNNING, SWIMMING, CYCLING, SOCCER ETC)?**

- 1. Yes Describe
- 2. No

**5. IN YOUR OPINION, ARE YOU AS PHYSICALLY ACTIVE AS YOU SHOULD BE?**

**(AT LEAST ONE HOUR PER DAY EQUIVALENT TO BRISK WALKING (FEELING WARM, SLIGHTLY OUT OF BREATH).**

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>1. Yes</li> </ul> | <ul style="list-style-type: none"> <li>3. Not active enough</li> </ul> |
|--|--|

2. More active			
<b>6. IF YOU FEEL YOU ARE NOT SUFFICIENTLY ACTIVE, WHAT DO YOU FEEL IS THE REASON? TICK✓ THE REASONS MOST APPLICABLE TO YOU.</b>			
Too little time.	1	Duties at home/ Family responsibilities	9
Not interested.	2	Lack of money.	10
I do not enjoy taking part in sport	3	Transport problem	11
Don't feel talented in sports	4	I feel guilty spending time on sport.	12
Too few of my friends participate with me.	5	I am scared of getting hurt.	13
Home work from school take a lot of my time.	6	Lack of sports facilities/coaches	14
Watching a lot of TV	7	Shortage of information with regard to sports/ activity choices	15
Illness/Poor health/Too tired	8	<b>Other reasons</b>	16

### 1 Activitygram questionnaire

1. On how many of the past 7 days did you participate in physical activity for a total of 30-60 minutes or more over the course of a day. This includes moderate activities (walking, slow cycling, or outdoor play) as well as vigorous activities (jogging, active games, or active sports such as basketball)

0 day	1 day	2 days	3 days	4 days	5 days	6 days	7 days
-------	-------	--------	--------	--------	--------	--------	--------

2. On how many of the past 7 days did you do stretching to strengthen your muscles? This includes exercises such as push-ups, sit-ups, or weight lifting.

0 day	1 day	2 days	3 days	4 days	5 days	6 days	7 days
-------	-------	--------	--------	--------	--------	--------	--------

3. On how many of the past 7 days did you do stretching exercises to loosen or relax your muscles? This includes exercises such as toe touches, knee bending, or leg stretching.

0 day	1 day	2 days	3 days	4 days	5 days	6 days	7 days
-------	-------	--------	--------	--------	--------	--------	--------

# **APPENDIX C**

**Previous Day Physical Activity Recall (PDPAR)  
questionnaire for the week and weekend**

Name:

Race:      
 W B C I

Age:    Date of Birth

Gender:  M  F

Grade:

School:

Teacher:

Date:

Classification:

**Think back about yesterday. For each of the 30 minutes periods, select a primary activity that you performed and write the type of activity in the type of activity column.**

Mark the day of the week that you fill in this form

Monday Tuesday Wed Thursday Friday

Time	Activity	METS		•	<input type="checkbox"/>	Very	Light	Med-	Hard
		<input type="checkbox"/>	<input type="checkbox"/>			light	ium	<input type="checkbox"/>	<input type="checkbox"/>
7:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21:30	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22:00	<input type="text"/>	<input type="checkbox"/>	<input type="checkbox"/>	•	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Name:

Race:  W  B  C  I

Age:    Date of birth

Gender:  M  V

Grade:

School:

Teacher:

Date:  d  d  m  m  y  y

Classification:

**Think back about the weekend. For each of the 30 minutes periods, select a primary activity that you performed and write the type of activity in the type of activity column.**

Mark the day of the weekend that you fill in this form

Saturday  Sunday

Time	Activity	METS	Day						
			Saturday	Sunday	Very light	Light	Medium	Hard	
7:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
7:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
8:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
8:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
9:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
9:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
10:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
10:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
11:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
11:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
12:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
12:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
13:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
13:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
14:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
14:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
15:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
15:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
16:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
16:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
17:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
17:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
18:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
18:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
19:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
19:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
20:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
20:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
21:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
21:30	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
22:00	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

# **APPENDIX D**

## **Physical fitness data sheet**

# PLAY-STUDY - DATA SHEET

<b>PLAY - DATA sheet</b>	<b>Subject no</b>		
<b>Name:</b>			
<b>Age:</b>		<b>Gender</b>	M    F
<b>Birth date:</b>		<b>Grade</b>	
<b>Test date:</b>		<b>Arm span</b>	

## 1.1 ANTROPOMETRIC MEASUREMENTS

<b>Stature</b>		<b>Calf sf</b>	
<b>Body mass</b>		<b>Abdominal</b>	
<b>Sub scapular sf</b>		<b>BMI</b>	
<b>Triceps sf</b>		<b>% Bodyfat</b>	

## 1.2 FITNESSGRAM

<b>Bleep-test (Levels)</b>		<b>PACER-test (Laps)</b>	
<b>Activity monitor</b>			
<b>Curl Up</b>		<b>Trunk lift</b>	
<b>Push Up</b>		<b>Standing long jump</b>	
<b>Sit and reach</b>	R	<b>Step up test</b>	
	L		
<b>Modified sit and reach</b>			
<b>Bent armhang (girls)</b>		<b>Pull-ups (boys)</b>	
<b>Handgrip strength</b>			

**Do you have any medical conditions/illnesses we should be aware of?**

# **APPENDIX E**

**Maturation questionnaire for boys and girls**

# MALE SELF-ASSESSMENT OF MATURITY CHARACTERISTICS

<b>Subject nr:</b>	<b>Name:</b>	<b>Age:</b>
--------------------	--------------	-------------

1. Have you already experienced a voice change? Tick  in the appropriate box.

<b>No</b> <input style="width: 80px; height: 25px;" type="checkbox"/> Unbroken	<input style="width: 80px; height: 25px;" type="checkbox"/> Signs of breaking	<b>Yes</b> <input style="width: 80px; height: 25px;" type="checkbox"/> Definitely broken/ adult quality
---	--	--

2. If applicable, circle the age/Grade in which you experienced signs of breaking of your voice.

Primary school				Secondary school				
10 years Grade 4	11 years Grade 5	12 years Grade 6	13 years Grade 7	14 years Grade 8	15 years Grade 9	16 years Grade 10	17 years Grade 11	18 years Grade 12

3. If applicable, encircle the age/Grade in which you experienced YOUR VOICE DEFINITELY BROKEN.

1.2.1 Primary school				Secondary school				
10 years Grade 4	11 years Grade 5	12 years Grade 6	13 years Grade 7.	14 years Grade 8	15 years Grade 9	16 years Grade 10	17 years Grade 11	18 years Grade 12

4. Do you think your voice broke at the same time, earlier or later than friends or boys of a similar age than you? Tick  in the appropriate box?

EARLIER <input style="width: 100px; height: 25px;" type="checkbox"/>	LATER <input style="width: 100px; height: 25px;" type="checkbox"/>	SAME TIME <input style="width: 100px; height: 25px;" type="checkbox"/>
--	--	--

5. If you have started shaving, in which Grade dit it happen?

Grade: <input style="width: 150px; height: 25px;" type="text"/>
Not yet: <input style="width: 150px; height: 25px;" type="text"/>

6. Do you think you started shaving at the same time, earlier or later than friends or boys with a similar age than you? Tick  in the appropriate box?

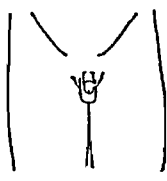
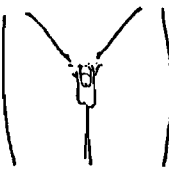
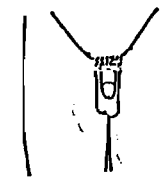
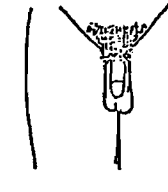
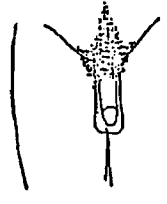
EARLIER <input style="width: 100px; height: 25px;" type="checkbox"/>	LATER <input style="width: 100px; height: 25px;" type="checkbox"/>	SAME TIME <input style="width: 100px; height: 25px;" type="checkbox"/>
--	--	--

7. The description on this page describes different amounts of male facial hair. Please read each of the descriptions. Then tick  the appropriate box that describes your stage of facial hair development best.

<input style="width: 30px; height: 20px;" type="checkbox"/> None	<input style="width: 30px; height: 20px;" type="checkbox"/> Increase in length, with pigmentation (darkening) at corners of upper lip, spreading medially to complete moustache.	<input style="width: 30px; height: 20px;" type="checkbox"/> Hair on the upper part of the cheeks and in the midline just below the lower lip.	<input style="width: 30px; height: 20px;" type="checkbox"/> Hair on the sides and lower border of the chin.
---	---	--	--

8. As you keep growing over the next few years, you will see changes in your body. These changes happen at different ages for different children and you may already be seeing some changes. Doctors use the set of drawings which is shown to you to determine stages of growth. These changes can be identified in 5 different phases. We want to determine how well you can select your stage of growth from the set of drawings. All you need to do is to pick the drawing and description that looks like you do. Make a tick ✓ above the drawing that is closest to your stage of development, then put the sheet in the envelope and seal it so your answer will be kept in private.

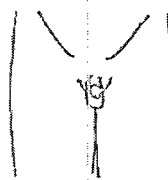
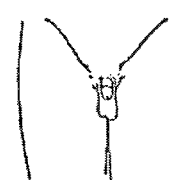
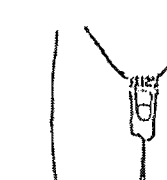
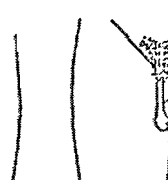
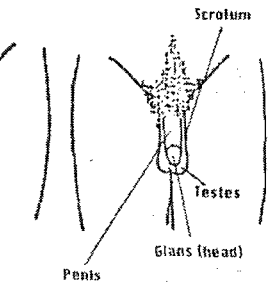
The drawings on this page show different amounts of **male pubic hair**. Please look at each of the drawings and read the sentences under the drawings. Then tick ✓ the drawing that is closest to your stage of hair development

Picture 1	Picture 2	Picture 3	Picture 4	Picture 5
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				
There is no pubic hair at all.	There is small amount of long, lightly coloured hair. This hair may be straight or a little curly.	There is darker hair, curlier and thinly spread out to cover a somewhat larger area than in stage 2.	The hair is thicker and more spread out, covering a larger area than in stage 3	The hair now is widely spread covering a large area, like that of an adult male.

9. In comparison to other boys of your age, how would you describe your development with regard to pubic hair development.

Much earlier	Somewhat earlier	About the same	Somewhat later	Much later
--------------	------------------	----------------	----------------	------------

10. The drawings on this page show different stages of growth of the testes, scrotum and penis. A boy goes through each of the 5 stages shown. Please look at each of the drawings and read the sentences under the drawings. Then tick ✓ the drawing that is closest to your stage of growth

Picture 1	Picture 2	Picture 3	Picture 4	Picture 5
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				
The testes, scrotum and penis are about the same size and shape as they were when you were a child.	The testes and scrotum are bigger. The skin of the scrotum has changed. The scrotum (the sack holding the testes) has gotten lower. The penis has gotten only a little bigger.	The penis has grown in length. The testes and scrotum have grown and dropped lower than in picture 2.	The penis has gotten even bigger. (It is wider. The head of the penis) is bigger. The scrotum is darker than before. It is bigger because the testes are bigger.	The penis, scrotum, and testes are the size and shape of that of an adult man.

11. In comparison to other boys of your age, how would you describe your development with regard to growth of the penis, testes and scrotum.

Much earlier	Somewhat earlier	About the same	Somewhat later	Much later
--------------	------------------	----------------	----------------	------------

Thank you for your time!

FEMALE SELF-ASSESSMENT OF MATURITY CHARACTERISTICS

<b>Name:</b>	<b>Gender:</b>	<input checked="" type="checkbox"/>	<b>F</b>	<b>Age:</b>
<b>Subject number:</b>				

1. Have your menstrual cycle (periods) started already? Tick  in the appropriate box.

Yes  No

2. When was your last period? (Indicate the number of days, weeks, months).

--	--

3. If you have started menstruating, encircle the age and the Grade when you did.

Primary school				Secondary school				
10 years Grade 4	11 years Grade 5	12 years Grade 6	13 years Grade 7	14 years Grade 8	15 years Grade 9	16 years Grade 10	17 years Grade 11	18 years Grade 12

4. Do you think you started menstruating at the same time, earlier or later than friends or girls with a similar age than you? Tick  in the appropriate box.

EARLIER  LATER  SAME TIME

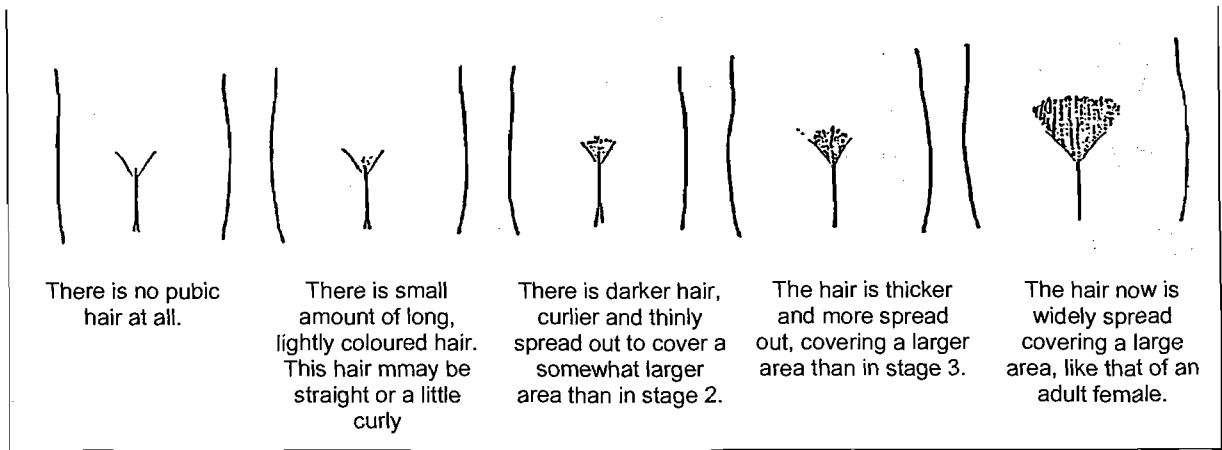
5. If possible, try to recall the exact date when you started menstruating (year, month)

Year:
Month:

6. As you keep growing over the next few years, you will see changes in your body. These changes happen at different ages for different children and you may already be seeing some changes. Doctors use the set of drawings of pubic hair development which is shown to you to determine stage of growth. These changes can be identified in 5 different phases. We want to determine how well you can select your stage of growth from the set of drawings. All you need to do is pick the drawing and description that looks like you do. Make a tick  above the drawing that is closest to your stage of development, then put the sheet in the envelope and seal it so your answer will be kept in private.

The following drawings show different amounts of female pubic hair development. Please look at each of the drawings and read the sentences under the drawings. Then tick  the drawing that is closest to your hair development.

Figure 1  Figure 2  Figure 3  Figure 4  Figure 5



7. In comparison to other girls your age, how would you describe your development with regard to pubic hair development.

Much earlier	Somewhat earlier	About the same	Somewhat later	Much later
--------------	------------------	----------------	----------------	------------

8. The following drawings show the amount of breast development. Please look at each of the drawings and read the sentences under the drawings. Then tick  the drawing that is **closest** to your breast development.

Picture 1	Picture 2	Picture 3	Picture 4	Picture 5

<p>The nipple is raised a little in this stage. The rest of the breast is still flat</p>	<p>This is the breast bud stage. In this stage the nipple is raised more than in stage 1. The breast is a small mound. The areola is larger than in stage 1</p>	<p>The areola and the breast are both larger than in stage 2. The areola does not stick out away from the breast.</p>	<p>The areola and the nipple make up a mound that sticks above the shape of the breast</p>	<p>This is the mature adult stage. The breasts are fully grown. Only the nipple sticks out in this stage. The areola has moved back to the general shape of breast</p>
--	---	---	--	--

9. In comparison to other girls your age, how would you describe your development with regard to breast development.

Much earlier	Somewhat earlier	About the same	Somewhat later	Much later
--------------	------------------	----------------	----------------	------------

Thank you for your time!

# **APPENDIX F**

**Submission guidelines for the South African  
Journal for Research in Sport, Physical Education  
and Recreation**

**Author Guidelines**

The *South African Journal for Research in Sport, Physical Education and Recreation* is published by the Stellenbosch University. Contributions from the fields of Sport Science, Movement Education, Recreation/Leisure Studies, Exercise Science and Dance Studies will be considered for publication. The articles submitted will be administered by the appropriate Subject Review Editor and evaluated by two or more referees. The decision as to whether a particular article is to be published or not, rests with the Editorial Board.

**SUBMISSION**

Manuscripts should be typed with one and a half spacing in 12-point Times New Roman letter size and printed on A4-size white paper in laser quality. The original manuscript (clearly indicated) and three copies of the manuscript must be submitted. Length must not exceed 20 pages (tables, figures, references, etc. included). Original manuscripts may be submitted in English or Afrikaans and should be sent to:

The Editor

S.A. Journal for Research in Sport, Physical Education and Recreation

Department of Sport Science

Private Bag X1

7602 Matieland, STELLENBOSCH

Republic of South Africa

***Editorial Office***

Tel: 021-808 4915 / 4724

Fax: 021-808 4817

E-mail: [floris@sun.ac.za](mailto:floris@sun.ac.za)

NB. Articles can also be submitted by e-mail.

## **CONDITIONS**

A signed declaration in respect of the originality must accompany each manuscript. On submission of the manuscript, the author shall present a written statement that the article has not been published or is not being presented for publication elsewhere. Should the article be taken from a Master's thesis or Doctoral dissertation, academic ethics requires that the student will be the first author. The author should also ensure that the LANGUAGE of the manuscript has been thoroughly edited at the time of submission. The name, address and telephone number of the person who has done the language editing must be provided. On receiving a written notification from the Managing Editor that the article has been accepted, a final hard copy of the manuscript and a disk (virus checked) should be submitted using MS WORD, Office 97 or 2000 as a DOC-file (see Figures). It can also be sent per e-mail as an attached file.

## **PREPARATION OF MANUSCRIPT**

### ***Title page***

The first page of each manuscript should indicate the title in English and Afrikaans (will be translated for foreign authors), the names (title, first name and other initials, surname) of the author(s), the telephone numbers (work & home), facsimile number, e-mail address (if available) and the field of study. The mailing address of the first named author and the institution where the work was conducted should be provided in full. A short title of not more than 45 characters, including the spaces, should be provided for use as a running head.

### ***Abstract***

Each manuscript must be accompanied by an abstract of approximately 150-200 words in English and should be set on a separate page as a SINGLE paragraph (one and a half spacing). Articles in Afrikaans must include an additional extended summary (500-1000 words) in English. This summary must start on a new page (following the list of sources) providing the English title of the article at the beginning. A list of three to seven key words in English is required for indexing purposes and should be typed below the abstract.

## **Text**

Start the text on a new page with the title of the article (centred and without the names of the authors). Follow the style of the most recent issue of the journal regarding the use of headings and subheadings.

**Tables and figures:** Tables and figures should be numbered in Arabic numerals (1, 2, etc.) and each be prepared on a SEPARATE page (also on the disk). Tables require a heading at the top and figures a legend below, separate from the figure. For figures, kindly supply the values of the co-ordinates of line or bar graphs in a separate MS EXCEL (.exl) or WORD file (.doc) while also including the actual figures in the same file. Only original and high-resolution laser quality copies of figures and drawings and original photographs can be accepted (photocopies or negatives are unacceptable) for scanning. Indicate where the tables or figures must feature in the text. The names of the authors must be indicated clearly on the back of the copy of each table and figure. Note: Use the decimal POINT (not the decimal comma).

**References:** In the text the Harvard method must be adopted by providing the author's surname and the date placed in parentheses. For example: Daly (1970); King and Loathes (1985); McGuines et al. (1986) or (Daly, 1970: 80) when Daly is not part of the sentence. More than one reference must be arranged chronologically. Note that et al. is used in the body of the text when there are more than two authors, but never in the list of references.

### **List of references**

Only the references cited in the text should be listed alphabetically according to surname (last name) of authors (capitals) after the body of text under the heading, references (capitals) starting on a new page. In the case of articles published in JOURNALS, references listed should include the surnames and initials (capitals) of all authors, the date of the publication in parentheses, the full title of the article, the full title of the journal (italics), the volume number, the serial number in parentheses (omitted only if said journal does not use issue numbers), followed by a colon and the first and last page numbers separated by a hyphen.

Example:

VAN WYK, G.J. & AMOORE, J.N. (1995). A practical solution for calculating instantaneous values of tension in the extensor muscles of the knee joint during extension and flexion. *South African Journal for Research in Sport, Physical Education and Recreation*, 18(1): 77-97.

If the reference is a BOOK, the surname (last name) and initials of the author or editor (Ed.) must be given, followed by the date of publication in parentheses, the title of the book (italics) as given on the title page, the number of the edition (ed.) in parentheses, the city (and abbreviation for the state in the case of the USA) where published, followed by a colon and the name of the publisher.

Example:

JEWETT, A.E.; BAIN, L.L. & ENNIS, C.E. (1995). *The curriculum process in physical education* (2nd ed.). Madison, WI: WCB Brown & Benchmark.

For a CHAPTER from a book, the page numbers of the chapter cited must be provided in parentheses (not italics) after the title of the book. For further details, authors should consult the most recent publication of this Journal for other examples.

Example:

DE RIDDER, J.H. (1999). Kinanthropometry in exercise and sport. In L.O. Amusa; A.L. Toriola & I.U. Onyewadume (Eds.), *Physical education and sport in Africa* (235-263). Ibadan (Nigeria): LAP Publications.

For ELECTRONIC SOURCES all references start with the same information that would be provided for a printed source (if available). The web page information follows the reference. It will usually contain the name of the author(s) (if known), year of publication or last revision, title of complete work in inverted commas, title of web page in italics, Uniform Resource Locator (URL) or access path in text brackets (do not end the path statement with a fullstop) and date of access. See "How to cite information from the internet and the world wide web" at <http://www.apa.org/journals/webref.html> for specific examples. When citing a web site in the text, merely give the address. Note that personal communications such as e-mail are cited only in the text and are not included in the list of references.

Example of Web Page:

ACKERMANN, E. (1996). "Writing your own Web Pages." *Creating Web Pages*. Hyperlink [<http://www.mwc.edu/ernie/writeweb/writeweb.html>]. Retrieved 22 October 1999.

## **ADMINISTRATION**

If authors honour the rules and specifications for the submission of manuscripts, unnecessary delays will be avoided. A manuscript that does not meet the requirements as set out above, will be returned to the author without being evaluated. Requesting copying rights concerning figures or photographs is the responsibility of the authors. The first-named author will receive five reprints of the article free of charge. The original manuscripts and illustrations will be discarded one month after publication unless a request is received to return the original to the first-named author. Page charges of R80 per page are payable on receipt of an account issued by the editor.

### **Submission Preparation Checklist (All items required)**

The submission has not been previously published nor is it before another journal for consideration; or an explanation has been provided in Comments to the Editor.

### **Copyright Notice**

Copyright for articles published in this journal is retained by the journal.

### **Privacy Statement**

The names and email addresses entered in this journal site will be used exclusively for the stated purposes of this journal and will not be made available for any other purpose or to any other party.

# **APPENDIX G**

**Submission guidelines for the African Journal for  
Physical, Health Education, Recreation and Dance**

**The African Journal for Physical, Health Education, Recreation and Dance (AJPHERD) is a peer-reviewed journal established to:**

- i) provide a forum for physical educators, health educators, specialists in human movement studies and dance, as well as other sport-related professionals in Africa, the opportunity to report their research findings based on African settings and experiences, and also to exchange ideas among themselves.
- ii) afford the professionals and other interested individuals in these disciplines the opportunity to learn more about the practice of the disciplines in different parts of the continent.
- iii) create an awareness in the rest of the world about the professional practice in the disciplines in Africa.

### **GENERAL POLICY**

AJPHERD publishes research papers that contribute to knowledge and practice, and also develops theory either as new information, reviews, confirmation of previous findings, application of new teaching/coaching techniques and research notes. Letters to the editor relating to the materials previously published in AJPHERD could be submitted within 3 months after publication of the article in question. Such letter will be referred to the corresponding author and both the letter and response will be published concurrently in a subsequent issue of the journal.

Manuscripts are considered for publication in AJPHERD based on the understanding that they have not been published or submitted for publication in any other journal. In submitting papers for publication, corresponding authors should make such declarations. Where part of a paper has been published or presented at congresses, seminars or symposia, reference to that publication should be made in the acknowledgement section of the manuscript.

AJPHERD is published quarterly, i.e. in March, June, September and December. Supplements/Special editions are also published periodically.

## **SUBMISSION OF MANUSCRIPT**

Three copies of original manuscript and all correspondence should be addressed to the Editor-In-Chief:

Professor L.O. Amusa

Tel: +27 15 9628076

Centre for Biokinetics, Recreation

Fax: +27 15 9628647

And Sport Science,

University of Venda for

Science and Technology,

P.Bag X5050,

Thohoyandou

0950

Republic of South Africa

Articles can also be submitted electronically, i.e. via e-mail attachment. However, the corresponding author should ensure that such articles are virus free. AJPHERD reviewing process normally takes 4-6 weeks and authors will be advised about the decision on submitted manuscripts within 60 days. In order to ensure anonymity during the reviewing process authors are requested to avoid self-referencing or keep it to the barest minimum.

## **PREPARATION OF MANUSCRIPT**

Manuscripts should be type written in fluent English (using 12-point Times New Roman font and 1½ line spacing) on one side of white A4-sized paper justified fully with 3cm margin on all sides. In preparing manuscripts, MS-Word, Office 98 or Office 2000 for Windows should be used. Length of manuscripts should not normally exceed 12 printed pages (including tables, figures, references, etc.). For articles exceeding 12 typed pages US\$ 10.0 is charged per every extra page. Longer manuscripts may be accepted for publication as supplements or special research reviews. Authors will be requested to pay a publication charge of US\$ 150.0 to defray the very high cost of publication.

Title page:

The title page of the manuscript should contain the following information:

Concise and informative title.

Author'(s)' name(s) with first and middle initials. Author'(s)' highest qualifications and main area of research specialization should be provided.

Author'(s)' institutional addresses, including telephone and fax numbers.

Corresponding author's contact details, including e-mail address.

A short running title of not more than 6 words.

Abstract:

An abstract of 200-250 words is required with up to a maximum of 5 words provided below the abstract. Abstract must be typed on a separate page using single line spacing, with the purpose of the study, methods, major results and conclusions concisely presented. Abbreviations should either be defined or excluded.

Text:

Text should carry the following designated headings: Introduction, materials and methods, results, discussion, acknowledgement, references and appendices (if appropriate).

### *Introduction*

The introduction should start on a new page and in addition to comprehensively giving the background of the study should clearly state the problem and purpose of the study. Authors should cite relevant references to support the basis of the study. A concise but informative and critical literature review is required.

### *Materials and Methods*

This section should provide sufficient and relevant information regarding study participants, instrumentation, research design, validity and reliability estimates, data collection procedures, statistical methods and data analysis techniques used. Qualitative research techniques are also acceptable.

### *Results*

Findings should be presented precisely and clearly. Tables and figures must be presented separately or at the end of the manuscript and their appropriate locations in the text indicated. The results section should not contain materials that are appropriate for presentation under the discussion section. Formulas, units and quantities should be expressed in the *systeme internationale (SI)* units. Colour printing of figures and tables is expensive and could be done upon request at author's expense.

### *Discussion*

The discussion section should reflect only important aspects of the study and its major conclusions. Information presented in the results section should not be repeated under the discussion. Relevant references should be cited in order to justify the findings of the study. Overall, the discussion should be written critically and tactfully.

### *References*

The American Psychological Association (APA) format should be used for referencing. Only references cited in the text should be alphabetically listed in the reference section at the end of the article. References should not be numbered either in the text or in the reference list.

Authors are advised to consider the following examples in referencing:

Examples of citations in body of the text:

For one or two authors; Kruger (2003) and Travill and Lloyd (1998). These references should be cited as follows when indicated at the end of a statement: (Kruger, 2003); (Travill & Loyd, 1998).

For three or more authors cited for the first time in the text; Monyeke, Brits, Mantsena and Toriola (2002) or when cited at the end of a statement as in the preceding example; (Monyeki, Brits, Mantsena & Toriola, 2002). For subsequent citations of the same reference it suffices to cite this particular reference as: Monyeki et al. (2002).

Multiple references when cited in the body of the text should be listed chronologically in ascending order, i.e. starting with the oldest reference. These should be separated with semi colons. For example, (Tom, 1982; McDaniels & Jooste, 1990; van Heerden, 2001; de Ridder et al., 2003).

### *Reference List*

In compiling the reference list at the end of the text the following examples for journal references chapter from a book, book publication and electronic citations-should be considered:

Examples of journal references:

Journal references should include the surname and initials of the author(s), year of publication, title of paper, name of the journal in which the paper has been published, volume and number of journal issue and page numbers.

For one author: McDonald, A.K. (1999). Youth sports in Africa: A review of programmes in selected countries. *International Journal of Youth Sports*, 1(4), 102-117.

For two authors: Johnson, A.G. & O'Kefee, L.M. (2003). Analysis of performance factors in provincial table tennis players. *Journal of Sport Performance*, 2(3), 12-31.

For multiple authors: Kemper, G.A., McPherson, A.B., Toledo, I. & Abdullah, I.I. (1996). Kinematic analysis of forehand smash in badminton. *Science of Racket Sports*, 24(2), 99-112.

Examples of book references:

Book references should specify the surname and initials of the author(s), year of publication of the book, title, edition, page numbers written in brackets, city where book was published and name of publishers. Chapter references should include the name(s) of the editor(s) and other specific information provided in the third example below:

For authored references: Amusa, L.O. & Toriola, A.L. (2003). *Foundations of Sport Science* (1<sup>st</sup> ed.) (pp. 39-45). Mokopane, South Africa: Dynasty Printers.

For edited references: Amusa, L.O. and Toriola, A.L. (Eds.) (2003). *Contemporary Issues in Physical Education and Sports* (2<sup>nd</sup> ed.) (pp. 20-24). Mokopane, South Africa: Dynasty Printers.

For chapter references in a book: Adams, L.L. & Neveling, I.A. (2004). Body fat characteristics of sumo wrestlers. In J.K. Manny and F.O. Boyd (Eds.), *Advances in Kinanthropometry* (pp. 21-29). Johannesburg, South Africa: The Publishers Company Ltd.

Examples of electronic references:

Electronic sources should be easily accessible. Details of Internet website links should also be provided fully. Consider the following example:

Wilson, G.A. (1997). Does sport sponsorship have a direct effect on product sales? *The Cyber-Journal of Sport Marketing (online)*, October, 1(4), at <http://www.cad.gu.au/cjism/wilson.html>. February 1997.

## **PROOFREADING**

Manuscript accepted for publication may be returned to the author(s) for final correction and proofreading. Corrected proofs should be returned to the Editor-In-Chief within one week of receipt. Minor editorial corrections are handled by AJPHERD.

## **COPYRIGHT AGREEMENT**

The Africa Association for Health, Physical Education, Recreation, Sport and Dance (AFAHPER-SD) holds the copyright for AJPHERD. In keeping with copyright laws, authors

will be required to assign copyright of accepted manuscripts to AFAHPER-SD. This ensures that both the publishers and the authors are protected from misuse of copyright information. Requests for permission to use copyright materials should be addressed to the Editor-in-Chief.

### **COMPLIMENTARY COPY OF AJIPHERD AND REPRINTS**

Principal authors will receive ten (10) complimentary copies of the relevant pages in which their article has been published. In case of two or more joint authors the principal author distributes the copies to the co-authors. Reprints of published papers can be ordered using a reprint order form that will be sent to the corresponding author before publication. Bound copies of the journal may be ordered from: Dynasty Printers, 26 Pretorius Street, Mokopane 0600, South Africa. Tel: +27 15 4914873; Fax: +27 15 4916411; E-mail:

[Ahmed@dynastyprinters.com](mailto:Ahmed@dynastyprinters.com); website: [www.dynastyprinters.com](http://www.dynastyprinters.com).

# **APPENDIX H**

## **Submission guidelines for the Journal of Teaching in Physical Education**

## Submission Guidelines, *Journal of Teaching in Physical Education*

In preparing articles for submission to the *Journal of Teaching in Physical Education*, authors must follow the *Publication Manual of the American Psychological Association* (5th ed., 2001). Copies can be found in most university libraries or in campus bookstores, or can be obtained directly (<http://www.apastyle.org/pubmanual.html>).

- All articles must include an abstract of 100–150 words typed on a separate page along with three to six key words not used in the title.
- The entire manuscript must be double-spaced. Line numbers should be inserted, continuous throughout the text, to facilitate the review process.
- Tables must be prepared using Microsoft Word's table-formatting functions.
- Manuscript length should not exceed 28 pages, including references, tables, and figures.
- Special attention should be given to the accuracy of the references and APA style.
- Figures must be crisp, clear, and properly labeled. Do not submit low-resolution electronic files.
- Manuscripts should not be submitted to another journal at the same time.

Submit your manuscript only through Manuscript Central, the online submission system for the *Journal of Teaching in Physical Education*. The Web address is [http://mc.manuscriptcentral.com/hk\\_jtpe](http://mc.manuscriptcentral.com/hk_jtpe).

Manuscript Central manages the electronic transfer of manuscripts throughout the article review process, providing systematic instructions and a user-friendly design. Please access the site and follow the directions for authors submitting manuscripts. Any problems that might be encountered can be easily resolved by selecting "Get Help Now" in the upper-right corner of any Manuscript Central screen. All manuscripts must be submitted using the Web-based system; we no longer accept submissions via mail or e-mail. To facilitate blind review, the first page of the manuscript should include *only* the title of the manuscript and the date of submission. The manuscript itself should contain no clues as to the author's identity. A separate cover sheet with contact information is **no longer required** because the necessary identifying information is entered in Manuscript Central.

Manuscripts will be acknowledged upon receipt and will be sent to two reviewers for blind review; the review process normally takes 2 to 3 months for an initial decision. Once the manuscript has been accepted, it will be published in the first available space after the final revision has been received. There are no page charges to authors. Authors of manuscripts accepted for publication must transfer copyright to Human Kinetics, Inc.

# **APPENDIX I**

## **Submission guidelines for Annals of Tropical Paediatrics**

Annals of tropical pediatrics

Original papers in English will be considered for publication provided that they have not been published previously and are not under consideration for publication elsewhere. Following peer review, any submissions accepted will be subject to editorial revision.

Declaration. An article will be published only if the following declaration has been received:  
I . . . . . , senior author of the paper entitled . . . . . , which I have submitted for publication in Annals of Tropical Pediatrics: International Child Health, hereby agree that, if it is accepted for publication in the Journal, the copyright of the paper shall become the property of The Liverpool School of Tropical Medicine who may on request licence me to reproduce the paper or any part thereof without requiring any payment in respect thereof, provided that a full acknowledgment to The Liverpool School of Tropical Medicine accompanies each reproduction. Any co-authors have seen this article and have agreed that it be submitted for publication in the Journal.

Date . . . . . Signature . . . . .

The following instructions relating to submissions must be adhered to. Failure to conform can lead to delay in publication.

Authorship. Only authors who have made a substantial contribution to the design of the study, the collection of data or the analysis and have been involved in the writing up of the article should be included in the list of authors. Otherwise, names should be mentioned in Acknowledgments. If an article appears to have an excess number of authors, the editors may request justification for their inclusion.

Methods of submission. Completely electronic submissions should be sent by e-mail to [vcoulter@liv.ac.uk](mailto:vcoulter@liv.ac.uk); the copyright declaration and highquality prints of any photographs, however, should be sent by letter post. There should be one file for the text of the paper (including tables, set using cells rather than tabs) and figure legends, and one for each of the figures. Any of the more common word-processing formats (e.g. Word or WordPerfect) should be used for the text file. Files containing figures should be in their original, fully editable format (e.g. Excel, SPSS, Harvard Graphics, Powerpoint). Greyscale or full-colour photographs should be sent only as hard copy.

Manuscripts submitted by post (to Editorial Assistant, Annals of Tropical Pediatrics, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, UK) should consist of one full paper copy, two sets of any figures and an IBM-compatible disk containing the relevant files.

**Typescript.** When preparing manuscripts, authors will find it helpful to refer to back copies of the journal. Text should be on one side of A4 paper, left-justified and double-spaced. The first page should carry the title of the paper, name(s) and affiliations of the author(s) and name and address of the corresponding author with, whenever possible, an e-mail address and fax number; failure to supply an e-mail address or fax number is likely to delay publication. A short running title should also be supplied.

**Original articles.** An abstract of not more than 250 words should be supplied on a separate page, outlining the background, aim(s), methods, results and conclusions (others added as appropriate). The text, starting on a new page, should be presented under appropriate headings: Introduction, Materials (or Patients) and Methods, Results, Discussion, Acknowledgments, References.

Case reports should have a shorter, unstructured summary with concluding sentence(s) summarising the important message of the report.

Short reports on clinical or laboratory observations should be limited to 1000 words and include an unstructured summary of less than 60 words, one or two tables or illustrations and a maximum of ten references. There should be no more than five authors.

Letters to the Editor should have a maximum of 400 words, one table or figure and not more than five references. No summary is necessary and headings, apart from 'References', are optional. Authors' names and addresses should be listed at the end of the text, before the references.

Abbreviations must not be used without explanation the first time they occur and SI units must be used, except for blood pressure which is reported in mmHg.

**Statistical methods.** Describe statistical methods in enough detail to enable a knowledgeable reader with access to the original data to verify the reported results. When possible, quantify findings and present them with appropriate indicators of measurement error or uncertainty (such as confidence intervals). Avoid relying solely on statistical hypothesis testing (such as the use of p-values) which fails to convey important quantitative information. Discuss the eligibility of experimental subjects. Give details about randomisation. Describe the methods for and success of any blinding of observations.

Report complications of treatment. Give numbers of observations. Report losses to observation (such as drop-outs from a clinical trial). References for the design of the study and statistical methods should be to standard works when possible (with pages stated) rather than to papers in which the designs or methods were originally reported. Specify any general-use computer programmes used.

Put a general description of methods in the Methods section. When data are summarised in the Results section, specify the statistical methods used to analyse them. Restrict tables and figures to those needed to explain the argument of the paper and to assess its support. Use graphs as an alternative to tables with many entries; do not duplicate data in graphs and tables. Avoid non-technical uses of technical terms in statistics, such as "random" (which implies a randomising device), "normal," "significant", "correlations" and "sample". Define statistical terms, abbreviations, and most symbols. The symbol  $\pm$  should not be used. Use "mean (SD)" instead.

Tables should be typed on separate pages, numbered with Arabic numerals, and a title provided for each. As mentioned above, they should be set using cells rather than tabs. Any footnotes should be typed beneath the body of the table. Vertical rules should be avoided.

Illustrations. Figures and plates should be used only when necessary to illustrate particular structures or conditions, to summarise data or to record quantitative results. They should be numbered with Arabic numerals in the order in which they are cited and their approximate position indicated in the margin of the text. Photographs should be supplied preferably as appropriate disk files, but otherwise as high-contrast, glossy prints. Special attention should be paid to clarity of all figures.  $\mu$ ,  $\sigma$ ,  $\rho$ ,  $\gamma$ ,  $\delta$ , and  $\epsilon$  are the preferred symbols on line graphs. Units involving multiplication (e.g. eggs/g faeces 10<sup>-3</sup>) should be avoided, either by converting the units (eggs/mg faeces) or by renumbering the relevant axis. Each illustration should be clearly labelled on the back with its figure number, the paper title and the name(s) of the author(s); the top of the illustration should also be indicated. Legends for illustrations should be typed on a separate sheet, not on the illustrations themselves. Subject to editorial discretion, up to 16 pages of each issue may carry colour figures free of charge to the authors.

References must be indicated by superscripted numerals in the text (e.g. '...has been reported.<sup>1</sup>' or '..., as shown by Soter.<sup>2</sup>'), numbered in the order in which they are first mentioned and listed in numerical order on a separate sheet at the end of the paper. References cited only in tables or illustrations must be numbered in accordance with the

sequence established by their first mention in the text. Titles of journals must be abbreviated according to Index Medicus. References (adhering to the Vancouver style) must include: (i) all authors' surnames and initials (if there are six authors or fewer) or, when there are seven or more authors, the first three authors, followed by '. . . , et al.'; (ii) full title of the paper; (iii) title of the journal; (iv) year of publication; (v) volume number, not issue number; (vi) first and last page numbers. Citation of chapters in books should include the author(s) and title of the chapter, editors' names, title of the book, city of publication, name of publisher, year of publication and page nos if appropriate.

Examples:

1 Balkaran BN, Roberts LA, Ramcharan J. Systemic lupus erythematosus in Trinidadian children. *Ann Trop Paediatr* 2004; 3:241–4.

2 Davis JM, Rosenfeld WN. Chronic lung disease. In: Avery GB, Fletcher MA, MacDonald MG, eds. *Neonatology; Pathophysiology and Management of the Newborn*. Philadelphia, PA: Lippincott, 1999; 29.

Rejected manuscripts will be held for 6 months before shredding. In exceptional circumstances, the top copy will be returned if requested before that time has elapsed.

Eprints. Authors of papers in the *Annals of Tropical Paediatrics: International Child Health* receive a screen-resolution PDF file of the published version. Orders for digital reprints may be made at the time proofs are distributed. A complete copy of the relevant journal issue will be sent about 3 weeks after publication.

Copyright. It is a condition of publication that authors vest copyright of their articles, including abstracts, in The Liverpool School of Tropical Medicine. This ensures full copyright protection and dissemination of the article and the journal to the widest possible readership in print and electronic formats, as appropriate. Authors may use the article elsewhere after publication without prior permission from the Publisher but with the permission of The Liverpool School of Tropical Medicine, provided that acknowledgment is given to the journal as the original source of publication. Authors are themselves responsible for obtaining permission to reproduce copyright material from other sources.

# **APPENDIX J**

**Submission confirmation from the South African  
Journal for Research in Sport, Physical Education  
and Recreation**

"Prof. M.F Coetsee" <mcoetsee@pan.uzulu.ac.za> 2007/03/07 09:57 AM >>>  
Beste Anita

MANUSKRIP 616

Ek is aangestel as die sub-redakteur vir die artikel "The physical fitness and physical activity status of 15-year-old adolescents in a semi-urban community" waarvan jy die korresponderende outeur is. Die artikel is nou deur die hande van 3 referente wie se kommentare aangeheg is saam met 'n kopie van die oorspronklike manuskrip.

Die referente stem saam dat hierdie navorsings raporteering wetenskaplike waarde het en publiseerbaar is.

Julle word versoek om die referente se verslae te bestudeer en om volledige kommentaar te lewer oor hoe julle die aanbevelings hanteer d.i. watter julle kan inwerk en watter nie. Laasgenoemde moet met 'n aanvaarbare rede vergesel word.

Die tabelle lyk ook baie groot maar die sal met die redakteur uitgeklaar moet word indien die manuskrip aanvaar word.

Baie dankie vir julle gereelde bydraes.

Erken asb ontvangs van hierdie e-pos.

Groete aan almal daar.

Marius Coetsee

# **APPENDIX K**

**Publication confirmation from the African Journal  
for Physical, Health Education, Recreation and  
Dance**

**ABSTRACT**

This study aimed to determine what factors would be seen as barriers, and motivators for adolescent of low socio-economic status (SES) to improve their PA (physical activity) and participation in sport and to determine their perception of their own PA level. Frequency and rank ordering analyses indicated that most learners walked to school and participated in sport. Too much homework, lack of money and family responsibilities were indicated as barriers while encouragement of parents and friends to participate with, were found to be motivational factors. After participation in a PA programme, perceptions changed and a better knowledge of the intensity of PA was found. This information is helpful to understand why children from low SES do not always participate in PA and what will motivate them to become more active.

**Key words:** Adolescents, sport participation, physical activity, barriers, perception, motivators.

# **APPENDIX L**

**Submission confirmation from the Journal of  
Teaching in Physical Education**

11-Apr-2007

Dear Mrs. Lennox:

A manuscript titled The effect of a physical activity programme on the activity patterns, physical activity levels and aerobic endurance of adolescents from a disadvantaged community: PLAY-study (JTPE-2007-0040) has been submitted by Prof. Anita Pienaar to the Journal of Teaching in Physical Education.

You are listed as a co-author for this manuscript. The online peer-review system, Manuscript Central, automatically creates a user account for you. Your USER ID and PASSWORD for your account is as follows:

Site URL: [http://mc.manuscriptcentral.com/hk\\_jtpe](http://mc.manuscriptcentral.com/hk_jtpe)

USER ID: [anitalennox@absamail.co.za](mailto:anitalennox@absamail.co.za)

PASSWORD:

Please note: Because it has been replaced by the enclosed single use password, your old account password will no longer work.

To enter your account and set a new password, please do the following:

1. Go to: [http://mc.manuscriptcentral.com/hk\\_jtpe](http://mc.manuscriptcentral.com/hk_jtpe)

2. Log in using this information:

Your USER ID is [anitalennox@absamail.co.za](mailto:anitalennox@absamail.co.za)

Your case-sensitive single use PASSWORD is TbYSZ5X8

3. Once you log in you will be prompted to enter a permanent password.

4. The next time you log in you will use your USER ID and the new password you provided.

Please note that the single use password will expire on Sat, 14 Apr 2007 19:45:09 GMT / Sat, 14 Apr 2007 15:45:09 EST.

If the single use password has expired, you can generate another new single use password by entering your email address into the Password Help function on your site log in page:

[http://mc.manuscriptcentral.com/hk\\_jtpe](http://mc.manuscriptcentral.com/hk_jtpe)

You can use the above USER ID and PASSWORD to log in to the site and check the status of papers you have authored/co-authored. This password is case-sensitive and temporary. Please log in at [http://mc.manuscriptcentral.com/hk\\_jtpe](http://mc.manuscriptcentral.com/hk_jtpe) to update your account information and change your password.

Thank you for your participation.

Sincerely,  
Journal of Teaching in Physical Education Editorial Office

# **APPENDIX M**

**Submission confirmation from Annals of Tropical  
Paediatrics**

----- Original Message -----

**From:** Coulter, Vanessa

**To:** Anita Lennox

**Sent:** Monday, September 17, 2007 11:57 AM

**Subject:** RE: Submission of a

Dear Mrs Lennox,

Thank you for this submission. We shall be in touch with you in due course. Meanwhile, please keep a note of the reference no. (07/159) and remember to quote it if writing to us about your paper.

With best wishes,

Vanessa Coulter  
*Annals of Tropical Pediatrics*

# **APPENDIX N**

## **Physical activity intervention programme**

## PLAY PROJECT

### 1 AEROBIC DANCE

According to literature adolescents must exercise with a heartbeat of 115 to 180 beats per minute. Music was chosen with the corresponding beats per minute, slower music was first used and as the programme progressed the music was changed to increase the tempo. Aerobic dancing, kata-boxing and dancing were used in this section of the programme.

### 2 BAL SKILLS AND COORDINATION

10 Balls, 50 cones and a whistle are needed for this section of the programme.

Time: 15 minutes

#### Phase 1: First six weeks

1. Put five rows of 10 cones half a meter apart.
2. Use a whistle to start and end the exercises
3. Do various footwork routines with the cones. Examples:
  - Run with high knees over the cones
  - Jump with two feet over cones
  - Jump with one leg at a time over the cones (right and left leg)
  - Do "grapevine" through the cones
  - Do "jumping jacks" through the cones
  - Jump sideways over cones
  - Do "pivot and push" movement through the cones
4. In the first three weeks only the cones were used
5. In the last week above mentioned exercises were done, but also ball skills
  - Dribble the ball zigzag through the cones with both hands
  - Dribble the ball over the cones, first with the right hand and then with the left hand
  - Dribble the ball between the cones with the feet
  - Rotate the ball around the body and do movements through the cones
  - Throw and catch the ball and move through the cones
  - Throw the ball from one hand to the other and move through the cones
6. There are many more options, these just form the basis.

## Phase 2: Second six weeks

This phase focused on throwing skills, teamwork and activities to improve speed.

1. Sprinting was done over 15 meters after which the major muscles were stretched.
2. The following group activities were done
  - Learners stand at the four corners of a square, the learners move one by one to the right as one learner throws the ball from his left-hand side.
  - Learners stand in a circle and kick the ball to each other. If the ball goes through some learners' legs, that learner is out or if the ball goes out between two learners, both these learners are out
  - Place cones in a square on the four corners. The learners stand in line behind one of the corners and complete the square along the corners. For example in the first line you must sprint, the second line you must skip, then two leg jump and lastly dribble the ball. For this exercise it is necessary to divide the learners into smaller groups so that it can be done in the form of a competition.
3. Soccer was played with the boys and netball with the girls or volleyball with boys and girls.

## Phase 3: Last six weeks

In this phase the intensity was increased by doing sprint exercises and using the cones as in week one to six. In this phase 10 cones were placed in a row, but the tenth cone was placed five meters from the ninth cone. The aim of this cone is that the learners complete the routine and must sprint from the ninth cone to the tenth cone.

1. The same routines were used as set in phase 1, because the learners know these routines.
2. The exercises are first done without the balls and later the balls are added to the routines. When the balls are added to the routines, group leaders are placed at the tenth cone with a ball. The learners do the routines and before they sprint to the tenth cone, the ball is thrown in different ways for example a straight ball, bounce ball or a high ball.
3. The leaders were also asked to hold the ball in their one hand and arm stretched high above the head. The learners do the routine through the cones and as they sprint to

the leaders, they must jump beside the leader and get the ball from the leader's hand.

The learners enjoyed this activity very much.

4. The tenth cone can also be placed in different positions for example in a straight line from the rest of the cones, at 45 - 90° from the rest of the cones. This can help with change of direction.

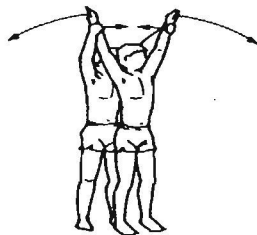
### 3 STRENGTH EXERCISES

This section of the programme will need 50 broomsticks and a whistle to complete.

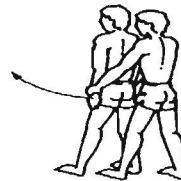
This is done for 15 minutes during each session.

#### Phase 1

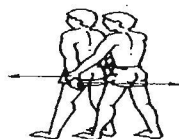
1. Two learners stand back to back and lock arms. They must try to sit and stand up again. They must do this five times without falling.
2. Learners stand behind each other. Learner B holds the wrists of learner A and gives resistance against learner A that must try to lift his/her arms sideways and back again to the side of the body (Picture 1). Hold for twenty seconds and repeat three times and learners switch and the exercise is repeated.



Picture 1

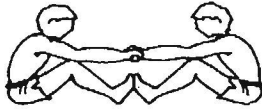


3. Two learners stand behind each other, legs apart. Learner B must hold the wrist of learner A and give resistance. Learner A must try to push the arms to the back (Picture 2). Hold for twenty seconds and repeat three times and learners switch their arms.



Picture 2

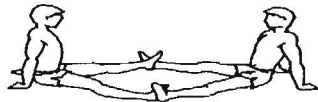
- Two learners sit on the ground with their feet touching, their legs slightly bent and they must hold a broom stick above their feet. Learners must try to pull each other off ground (Picture 3). Do 5-10 times and see which learner wins.



Picture 3

- Two learners sit with legs apart, feet touching each other on the inside. They must give resistance to each other trying to push legs open or close (Picture 4).

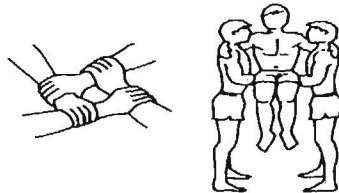
This is done for twenty seconds and repeated three times, and learners switch legs.



Picture 4

Learners run in a specific area and as a whistle blows, the learners must form groups of three learners. Two groups of three learners must come together and each stand at a cone (two cone are placed approximately 15 meters from each other). These activities are done on a relay basis.

- Two learners must carry one learner as shown in picture 5, and repeat three times each learner gets a chance to be carried.



Picture 5

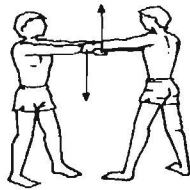
- Three learners standing at cone one, take a broomstick and hold it above their heads and run to the next team, standing at cone two, give the broomstick to the team at cone two that must run back to cone one.
- Three learners hold a broomstick alongside the body, and they must jump on one leg to the team at cone two.
- Learners sit with legs straight and try to stretch as far as possible trying to touch their toes. Hold for 10-20 seconds and repeat three times.

10. Learner sits with right leg straight and left leg bended so that the left foot is touching the right knee. The learner must stretch and see if he/she can touch his/her right toes. Hold for 10-20 seconds and repeat three times.

### Progression

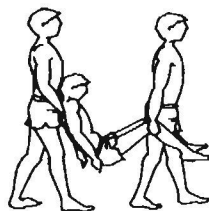
(These activities are replaced with some of the activities mentioned above; because these activities are more difficult and new activities are introduced to the learners).

1. Two learners stand with their backs to each other and arms locked. They must try to pull each other forward.
2. Two learners stand facing each other and legs apart, their arms are held at shoulder height. Learner A holds the wrist of learner B who tries to push his arms to the ground, learner A must give resistance (Picture 6). Do for 20 seconds, repeat three times and learners switch arms.



Picture 6

3. Two learners hold a broomstick and must jump like frogs (sit in squatting position, jump up in the air, legs must be straight and land again in the squatting position). Do this exercise over a distance of 15 meters and repeat three times.
4. Learners must carry each other as in picture 7.



Picture 7

5. Three learners run relay with a broomstick that is held at shoulders height.

## Phase 2

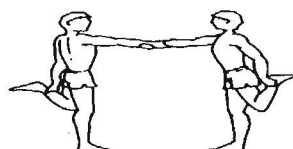
This phase will need frisbees and a whistle to complete.

These exercises are done in a relay over a distance of 15 meters.

1. Crabwalk (learner must sit on his/her buttocks, hands on the ground at the back, lift body so that the whole body is carried on the hands and feet), with frisbee on stomach.
2. Run with frisbee on the head
3. Wheelbarrow push: One learner push another like a wheelbarrow, frisbee is on the learners' back.

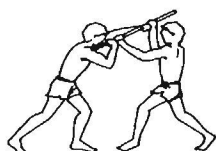
Learners run in specific area as whistle blows they must put four hands together, that is groups of two learners per group.

4. Two learners face each other in a push-up position. They must try to lift each other's hands off the ground.
5. Two learners face each other and hold each other's right wrist. They lift their left leg and hold the leg at the left ankle with their left hand. Learners must try to pull each other while jumping on one leg (Picture 8). Switch hand and leg and do the same with the right leg.



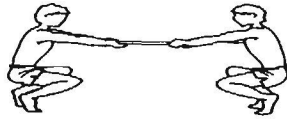
Picture 8

6. Two learners hold a broomstick with alternative grip. Each learner must try to turn the broomstick clockwise or anti-clockwise (Picture 9).



Picture 9

7. Two learners sit in a squatting position holding a broomstick (or holding each other's wrists). Learners jumping in a squatting position must try to pull each other over an imaginary line (Picture 10).

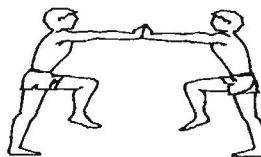


Picture 10

8. See-Saw: Two learners sit with their foot soles touching each other and holding hands. They must try to hold that position for 30 seconds, repeat three to four times.
9. Two learners stand with their backs against each other, they lean forward taking each others hands between their legs, they must pull towards each other with their hands. Hold for 30 seconds and repeat three to four times.

#### Progression

1. Two teams competing against each other with one leg jump and frisbee on knee.
1. Two teams throwing frisbee to each other, the learner that throws the frisbee must run to the learner that must catch the frisbee and stand at the back of the queue.
2. Two teams: wheelbarrow with frisbee on learner's back (wheelbarrow) but the wheelbarrow must give resistance to the learners that push the wheelbarrow.
3. Two learners in push-up position, facing each other. Each learner lifts up one hand and touches the other learner's hand, alternating hands. Do 20-30 repetitions.
4. Two learners facing each other with one leg in the air, and palms of hands touching each other. Learners must try to push the other off balance so that the raised leg touches the ground (Picture 11). Legs are alternated and repeated 10 times, five times with each leg.

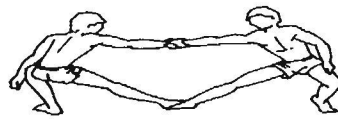


Picture 11

5. The same exercise as number 6 above, but the broomstick must be turned or pulled out of the partner's hand.

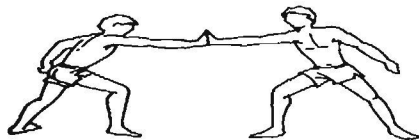
### Phase 3

1. Two learners sitting on their buttocks facing each other, holding hands and feet touching. Partners use each other to stand up and sit again.
2. Watch walk: Learners in push-up position, walk with their hands, while the feet stay at one place. Two learners can try to catch each other.
3. Two learners stand with their right shoulders touching, they take each other's right hand, their right feet must touch each other. They turn their left feet outside and on a whistle they must try to pull their partner over an imaginary line (Picture 12).



Picture 12

4. Buttocks balance: Learners sit on their buttocks with feet and hands off the ground. Which learner can hold this position the longest?
5. Two learners stand with their palms against each other, and legs in a scissor position (Picture 13). Learners must try to push each other over a distance.



Picture 13

6. Two learners in sit-up position facing each other. Learner one holds a broomstick and lies on his back, he comes up and gives the broomstick to learner two that has come up to get the broomstick. The same movement is repeated. Do 30-50 repetitions.
7. Two learners sit facing each other with legs wide apart and feet touching and holding hands. The learners pull towards each other and rotate their arms and upperbody in a circle. Do this for 30 - 60 seconds.

## Progression

1. Tiger jumps: Place broomsticks in a row on ground a distance apart. The learners stand in a squatting position in front of the first broomstick and jump over the broomstick with hands first and then the feet.
2. Push-up tunnel: Learners make a line all facing the front, all the learners get down in the push-up position and hold the position allowing a learner to crawl through the tunnel, or try to roll a ball through the tunnel. Repeat 10 times.
3. Two learners sit in sit-up position facing each other. They lift up their feet and touch each other's feet. Do two sets of 20 repetitions.
4. Two learners facing each other in sit-up position and feet against each other. Learners lie on their backs, they come up and touch each other's hands. Do two sets of 20 repetitions.

\*\*\*\*\*