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PHYSICAL FITNESS AND THE PHYSICAL ACTIVITY STATUS OF 15-YEAR-OLD ADOLESCENTS IN A SEMI-URBAN COMMUNITY

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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 of two schools were selected for the study: School 1 (N=252), 116 boys; 136 girls, School 2 (N=66), 21 boys; 45 girls. The testing protocol included fitness tests for aerobic endurance, flexibility and body composition and the PDPAR questionnaire to determine PA 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 significant 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 physical activity and physical fitness are associated with various health-risk factors (Pate *et al*., 1999; Sharkey, 2002), whilst higher levels of physical activity are associated with enduring health and vitality (Hall & Fong, 2003).

The literature indicates that there is a decline in the levels of physical activity among boys and girls during their teenage years and into early adulthood (Leslie *et al.*, 2001; Kemper, *et al.*, 2001; Neumark-Sztainer *et al.*, 2003). Engelbrecht *et al.* (2001) report 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 is also indicated by researchers (Pate *et al*., 1999; Sharkey, 2002) that there is a relationship between PA levels during childhood and adulthood. Kriska (2000) and Prinsloo and Pienaar (2005) indicate that greater domestic responsibilities of children from low socio economic environments contribute to higher levels of energy expenditure and hence higher levels of physical activity among them. In addition, children from rural environments usually walk 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).

There are minimum standards for physical fitness described by Meredith and Welk (1999), 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).

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 learners from a disadvantaged community. This analysis includes establishing whether their PF status falls within the HFZ as reported in the Fitnessgram measuring instrument. A second aim was to determine which of the PF components makes 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

This research forms part of the multi-disciplinary and longitudinal PLAY study (*Physical Activity in Youth*), the overall purpose of which is to investigate the effect of a physical activity intervention programme for adolescents and to determine whether exercise will affect physical activity and physical fitness and specifically, retarded growth (stunting). This study is based on a cross-sectional study design. Two high schools in Ikageng (a semi-urban area) in the Potchefstroom area of 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.

Sample

A high school nearby 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, indicating that this school was financially better off and that their nutritional status was possibly better than those 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 Grade 8 learners (16 boys and 136 girls) in School 1 and sixty-six Grade 8 learners (21 boys and 45 girls) in School 2 granted informed consent to participate in the study. No physical education classes or organised sport are presented during school hours 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 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, concert, 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 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 were recorded and the number of hours were 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 (example Bortjie, Kaizer).

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 = Weight (kg)/[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 Organization (WHO) and recorded as a height-for-age Z-score ≤ -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 (Meredith & Welk, 1999)

The *Fitnessgram* 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 & 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 3 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 proper 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), are 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 & 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 forwards as possible, and hold the position for one second during the fourth attempt. The furthest 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 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 kg.

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

Modified sit-and-reach: This test measures the flexibility of the lower back and hamstrings by means of a standard box and metre stick (Docherty, 1996). 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 (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 Lickert scale, determines 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 program. 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 also walked longer distances than those from School 2 where only

one (1.5%) walked between three and five km. In contrast, the majority of the learners of School 1 (52.0%) walked between three and five km. These learners carried very little to school therefore it was not felt necessary to report any information regarding this.

TABLE 1. **DISTANCES WALKED TO SCHOOL BY LEARNERS FROM BOTH SCHOOLS**

	School 1		School 2	
Walking distance	***N***	***%***	***N***	***%***
500 m - 2 km	89	35.3	65	98.5
3 km – 5 km	131	52.0	1	1.5
6 km - 10 km	30	11.9	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 of 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). Significant differences were also found between the boys of the two schools in their stature, sub-scapular and triceps skin folds and percentage body fat. Although the boys of School 1 were significantly older and taller than those of School 2, the boys of School 2 had bigger sub-scapular and triceps skin folds as well as a higher percentage body fat ($p = 0.020$).

Significant differences were also found in the body composition of the girls (Table 2). Although the girls of 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.

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***
Boys	*School 1 (n=116)*				*School 2 (n=21)*				
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*
Girls	*School 1 (n=136)*				*School 2 (n=45)*				
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

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**

Variables	***Mean***	***SD***	***Min***	***Max***	***Mean***	***SD***	***Min***	***Max***	***p***
Boys	***School 1***				***School 2***				
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*

Variables	*Mean*	*SD*	*Min*	*Max*	*Mean*	*SD*	*Min*	*Max*	*p*
Boys		***School 1***				***School 2***			
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	3.31	2.10	0.0	9.5	3.62	2.50	0.0	9.5	.553
Girls		***School 1***				***School 2***			
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
Girls		***School 1***				***School 2***			
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

Due to the older age of the girls of School 1, it was expected that they would have greater percentages of fat than girls of 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 are stunted.

Table 3 shows that the PF status of boys in Schools 1 and 2 are similar. Significantly better trunk strength and flexibility was found in School 2 boys, whilst School 1 boys had better hand grip strength. Although not at the 5% level of significance, the boys of 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 of 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 of School 1 had better aerobic fitness, which can possibly be attributed to the fact that they walked further distances to school, compared to the boys and girls of School 2 (Table 1). However, from a maturity point of view the higher mean age of this group of boys may also have contributed to these results.

The analysis in Table 3 indicates no significant differences in the PA levels of the boys of the two schools. The boys of both schools were classified as moderately active during the week and

weekend, while boys of School 2 watched more television during the week as well as the weekend. The girls of School 1 were moderately active and also significantly more active compared to the girls of 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).

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	
Boys	***Mean***	**HFZ**	***Mean***	**HFZ**
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
Girls				
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, RF = Risky Fitness Zone, BMI = Body Mass Index

Table 4 shows that the boys of 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 Fitnesgramm, 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 of School 2 and girls of both schools in the overweight category.

Table 4 indicates that 5 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 of 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 of School 1 fell into the HFZ, which was not the case with the girls in School 2.

The next part describes an analysis of possible relationships between PA and PF. Table 5 revealed 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 week. This indicates that more active girls have smaller skin folds. PA 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.

The distance boys walked to school had a significantly positive relation to grip strength, flexibility and PA during the weekend. In the group, the distance walked to school showed low but significant relationships with PA during the week and weekends. 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, 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.

TABLE 5. **RELATIONSHIPS BETWEEN PHYSICAL ACTIVITY AND PHYSICAL FITNESS**

	Total group			Boys			
Total group	**W**	**WE**	**Dist**	**W**	**WE**	**Dist**	**Pull-ups**
Age	.05	-.00	.12	.03	-.11	.19*	.44*
Time	.06	-.04	.50*	.02	.04	.45*	.12
Place	.14	.15*	.98*	.05	.21*	.98*	.04
Stature	.05	-.06	.14	-.07	-.17	.21*	.10
Mass	-.10	-.14*	.07	-.11	-.16	.17	.18
BMI	-.19*	-.18*	.00	-.22*	-.16	.04	.10
Sub-scapular skinfold	-.27*	-.22*	-.08	-.20*	-.14	-.12	-.03
Triceps skinfold	-.30*	-.19*	-.13	-.23*	-.01	-.04	-.28*
Calf skinfold	-.24*	-.12	-.09	-.18	.05	-.09	-.25*
Abdominal skinfold	-.27*	-.21*	-.10	-.21*	-.04	-.07	-.16
Fat % BP	-.21*	-.11	-.13	-.09	.04	-.10	-.40*
Percentage fat	-.30*	-.20*	-.11	-.24*	-.01	-.07	-.25*
Aerobic fitness	.23*	.23*	.13	.10	.09	.06	.26*
Sit-and-reach-R	-.16*	-.08	-.07	-.13	-.00	.08	.22*
Sit-and-reach-L	-.16*	-.13	.06	-.18	-.05	.21*	.13
Mod. sit-and-reach	-.14*	-.13	.08	-.16	-.09	.17	.21*
Trunk flexibility	-.06	-.01	-.01	-.03	.06	-.10	-.02
Curl-ups	.09	.13	.10	.01	.20*	.07	.07
Push-ups	.13	.19*	.06	.00	.08	.03	.50*
Standing long jump	.11	.21*	.03	.03	.11	-.02	.32*
Handgrip strength	.00	-.04	.13	-.06	-.10	.19*	.43*
PA week	1.00	.29*	.14*	1.00	.22*	.07	.09
PA weekend	.29*	1.00	.14*	.22*	1.00	.19*	.07
TV week	-.22*	-.11	-.03	-.28*	-.13	.01	.04
TV weekend	-.04	-.11	-.05	.01	-.08	.01	.08

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

DISCUSSION

The results of this study regarding the physical fitness status of this group of learners from a disadvanged community showed that their physical fitness status, including aerobic fitness, flexibility and body composition are of such a nature that they will derive health benefits from it. The reasonably high fat percentage in the group, is however a concern. Strength (in all the different areas of the body that were assessed) was, however, not sufficient to provide health benefits. It is therefore imperative that attention should be given to this 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 of School 1 and the boys of School 2. Physical activity guidelines for adolescents require 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 can be considered sufficient to obtain health benefits from it. Only the girls in School 2 were categorised into the low PA category, indicating that they are 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 are also reported by Coe *et al*. (2006). From a health perspective, this sedentary choice of activity is a reason for concern about these learners. Pate *et al*. (1997) indicate 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 of 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 report that children who walk to school are 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 each other.

In conclusion, the results of this study indicate that the PF of the learners of School 1 is better than those of School 2 and that they are more active and watch less television than learners of School 2. It is further concluded that week and weekend PA and percentage body fat are 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 indicates 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 sport participation 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.

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