

## **Health-related fitness, body composition and physical activity status among adolescent learners: The PAHL study**

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### **Abstract**

Physical inactivity (PI) is found to be a major contributor to the high incidence of overweight and obesity among children and adolescents. As such, PI was significantly related to risk factors of cardiovascular disease. Studies especially in the 14-years in adolescents' learners are sparse. The purpose of this study was to determine the health-related physical fitness (HRPF), body composition and physical activity (PA) status among adolescent learners. A total of 283 adolescents learners (111 boys and 172 girls) with mean age of  $14.90 \pm 0.72$  years from the Physical Activity and Health Longitudinal Study (PAHLS) were participants in the study. Body composition according to the standard procedures of the International Society for the Advancement of Kinanthropometry (ISAK), HRPF using the Eurofit protocol test and PA levels using the International Physical Activity Questionnaire (IPAQ) were assessed and administered. Subsequently, total PA scores were calculated. The results show that on average, the boys ( $165.41 \pm 9.55$ cm) were significantly taller than the girls ( $157.88 \pm 6.94$ cm) ( $p < 0.000$ ). Girls had a slightly higher significant BMI ( $21.43 \pm 4.37$  kg/m<sup>2</sup>) than the boys ( $20.01 \pm 3.71$ kg/m<sup>2</sup>) ( $p = 0.002$ ). When the learners were categorised based on their BMI scores, the girls were more overweight (32.4%) compared to the boys (17.1%). Additionally, the girls (%body fat  $26.01 \pm 8.51$ ) were substantially ( $p < 0.000$ ) fatter than the boys ( $13.19 \pm 8.56$ ). Furthermore, the results also indicated that the boys had consistently better performances in all the HRPF tests than the girls ( $p < 0.000$ ). More girls (19%) than boys (16%) watched TV for more than 3 hours daily. A total of 85 (30%), 78(27.5%) and 88(31.1%) of the adolescent students had low, moderate and high PA involvement. It was concluded that girls were more overweight and less active than boys. In view of the health implications of the findings, there is a need to create enabling environment and opportunities that will promote physically active lifestyle and develop life-long positive attitudes towards PA among the learners. Community-based strategies designed to facilitate effective and sustainable PA intervention programmes in schools are recommended.

**Keywords:** Health-related physical fitness, body composition, physical activity, adolescents, PAHL study.

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## **Introduction**

The World Health Organisation (WHO) has declared obesity a global epidemic (WHO, 2009). The Centres for Disease Control and Prevention (CDC) (2009) and WHO (2009) have also reported an increasing prevalence of cardiovascular and metabolic diseases such as hypertension, stroke, hypercholesterolemia, obesity, overweight and diabetes mellitus in children and adults (Rivera, Mendoca-Da Silva, Almeida-Silva, Viana-Deoliveria & Camargo-Carvalho, 2009). A number of studies have identified over-consumption of high-calorie diets and physical inactivity (PI) as major contributory causes of the high incidence of overweight and obesity among children (Wiecha, Whitney & Bredin, 2004; Coleman, Tiller, Sanchez, Heath, Sy, Milike & Dzewartowski, 2005; Andreasi, Michelin, Rinaldi & Burini, 2010). For instance, Wiecha, Ayadi, Fuemmeler, Carter, Handler, Johnson, Strunk, Korzec-Ramirez & Gortmaker (2004) reported that the prevalence of overweight children and adolescents has doubled between 1976 and 1994 to 13% and has increased further to 15.5% in 2000. This trend is alarming given the fact that antecedents of chronic diseases in adulthood could be tracked from childhood (Forrest & Riley, 2004). The increasing prevalence and serious consequences of paediatric overweight and obesity have prompted calls for broad public health strategies to prevent the disease (Foster, Sherman, Borradaile, Grundy, Vander, Nachmani, Karpyn, Kumanyika & Shults, 2008).

In South Africa, a national study by Reddy, Panday, Swart, Jinabhai, Amosun & James (2003) among adolescents reported that only 54.3% have Physical Education (PE) classes on their timetable and only 52.8% engage in vigorous activity at school. This trend is disconcerting given that PE and physical activity (PA) provide opportunities for development of physical fitness in children. Also alarming is the fact that PE is neglected in the South African public school system with many schools constructed without playgrounds (Reddy, Panday, Swart, Jinabhai, Amosun & James, 2002). Since PA in childhood tracks into adulthood, it is necessary to address the lack of PA in children and youth in order to facilitate the prevention of risk factors of chronic diseases of lifestyle (CDL), which are now increasingly prevalent in children and youth (Telama, Yang, Vikari, Valimaki, Wane & Raitakari, 2005). In addition, it is believed that the largest percentage of variation in performance accounted for by chronological age, skeletal age and body size generally occur at age 14, in which height and weight are found to be interrelated (Malina, Bouchard & Bar-Or, 2004), hence the Physical Activity and Health Longitudinal Study (PAHLS)(Monyeki, Neetens, Moss & Twisk, 2012).

Research carried out in Ellisoras (Mantsena, Monyeki, Monyeki, Brits, Toriola & Kangolle, 2003; Monyeki, Koppes, Kemper, Monyeki, Toriola, Pienaar & Twisk, 2005) and the Tshannda (Amusa, Goon & Amey, 2010) rural areas both in Limpopo Province of South Africa have consistently reported body weight disorders and incidence of health-risk behaviours in school children and adolescents. Available cross-sectional studies undertaken in South Africa, which investigated the relationship between PA and determinants of cardiovascular disease among children and adults (Kruger, Venter & Vorster, 2003; Mamabolo, Kruger, Lennox, Monyeki, Pienaar, Underhay & Czapka-Matyasik, 2007) also revealed that inactivity was significantly related to risk factors of cardiovascular disease.

The concepts that are central to CDL and health risk behaviours as well as their prevention and management include health-related physical fitness, body composition and PA. Health-related physical fitness in this context refers to a set of attributes that relates to the ability to perform daily physical and functional tasks (Ruiz, Ortega, Meusel, Harro, Oja & Sjostrom, 2006; Andreasi, Michelin, Rinaldi & Burini, 2010). While poor health-related physical fitness is often associated with the risk of premature development of morbidity, especially if an individual leads a sedentary lifestyle (Telama, Yang, Vikari, Valimaki, Wane & Raitakari, 2005), desirable health-related physical fitness prevents disease risk and improves the quality of life (Andreasi et al., 2010). Specifically, attributes of health-related fitness include body composition, cardiovascular endurance, flexibility, muscular endurance, muscular strength (US Department of Health and Human Services, 1999) and metabolism (Warburton, Whitney & Bredin, 2006).

In this study, PA is defined in the context of any bodily movement produced by skeletal muscles that results in energy expenditure, and is positively correlated with physical fitness, e.g. walking, jogging, cycling, swimming, domestic chores and gardening (Caspersen, Powell & Christensen, 1985). PA can be categorised as having low, moderate and high intensities depending on one's caloric expenditure as a function of time of activity, body weight and oxygen uptake (American College of Sport Medicine: ACSM, 2009). According to the ACSM (2009) participation in at least 30 minutes of moderate PA per day, carried out thrice a week will yield significant health benefits, while the WHO (2009) suggests that one should take at least 10,000 walking step counts per day for health promotion.

In spite of these recommendations people in many parts of the world are still inactive, leading to increased prevalence of cardiovascular and metabolic diseases (Mokdad, Ford, Bowman, Dietz, Vinicor, Bales & Marks, 2003). For example, people prefer to be driven to work, school or shopping malls and to use elevators or escalators rather than walk or climb the stairs. There is consensus

among researchers that the antecedents of chronic diseases of lifestyle (CDL) already manifest in childhood (Strong, Malina, Blimkie, Daniels, Dishman, Gutin, Hergenroeder, Must, Nixon, Pivarnik, Rowland, Trost & Trudeau, 2005; Jonker, De Laet, Franco, Peeters, Mackenbach & Nusselder, 2006). Research findings have also indicated a rising trend of chronic diseases of lifestyle among children and youth (Jessup & Harrell, 2005). The increasing trend of health risk behaviours have been widely associated with the fact that many children spend several hours watching TV, playing computer video games and hardly engage in wholesome PA (Andersen, Crespo, Bartlett, Cheskin & Prattbl, 1998). This trend is also aggravated by globalisation which has promoted the proliferation of fast food franchises most of which sell unhealthy foods. Therefore, poor dietary habits combined with PI and other unhealthy lifestyle factors undoubtedly increase cardiovascular and metabolic disease risk among children and adults (Kelishadi, Ziaee, Ardalan, Namazi, Noormohammadpour, Ghayour-Mobarhan, Sadraei, Mirmoghtadaee & Poursafa, 2010).

Therefore, given the importance of health-related physical fitness (HRPF), PA and body composition in disease prevention, this study was primarily designed to assess these dependent measures among high school adolescents in Tlokwe Local Municipality of the Dr Kenneth Kaunda District Municipality in the North West Province of South Africa. A secondary purpose of the study was to examine the inter-relationships among health-related fitness, PA and body composition in the adolescent learners. It was hypothesised that there will be significant gender differences in health-related fitness, PA and body composition status among the adolescent learners.

## **Methodology**

### *Research design*

This research was part of a larger study, i.e. The Physical Activity and Health Longitudinal Study (PAHLS), which utilised a mixed longitudinal design. The PAHLS was designed to evaluate the development of PA, determinants of health risk and factors affecting participation in sport and recreational activities among 14 year-old high school students in Tlokwe Local Municipality of the Dr Kenneth Kaunda District Municipality. For the purpose of this study data from cross-sectional measurements were used.

### *Participants*

The research involved a group of 283 boys (n=111) and girls (n=172), aged 14 years who were purposefully drawn from six out of eight secondary schools in Tlokwe Local Municipality. The schools included were those who granted permission for the study to be carried out. The participants were requested to

provide demographic information in terms of their gender status, race and locality (*i.e.* town or township). For the purpose of this study, school-based locality comprised four schools from town and four schools located in township areas. Therefore, the included schools covered both low (Ikageng Township) and high socio-economic circumstances (Potchefstroom town) of learners. The South African Department of Education categorize schools in quintiles (1-5) according to physical condition, facilities and crowding and the relative poverty of the community around the schools (Department of Education, 2003). Out of the eight schools initially selected, two urban schools declined to participate (without providing reasons). Detailed information regarding the participants has been published elsewhere (Monyeki, Neetens, Moss & Twisk, 2012)

#### *Anthropometric measurements*

The participants' height, body weight, skinfolds thickness (triceps and subscapular skinfolds), and waist and hip circumferences were measured using the standard procedures described by the International Standard of Advancement of Kinanthropometry (ISAK) (Marfell-Jones, Olds, Steward & Carter, 2006). Waist-to-hip ratio (WHR) was calculated as waist (cm)/hip (cm). Body mass index (BMI) was calculated as body mass/stature<sup>2</sup> (kg/m<sup>2</sup>). Subsequently, age-specific BMI for children was used to determine the following categories: overweight, normal weight and underweight/thinness, respectively (Cole, Bellizzi, Flegal & Dietz, 2000; Cole, Flegal, Nicholls & Jackson, 2007). Percentage body fat was calculated from skinfolds measurements using Slaughter, Lohman, Boileau, Horswill, Stillma, Van Loan & Bemben's (1988) equation which is internationally accepted for the use in children and adolescents from different ethnic groups.

#### *Health-related physical fitness measurements*

Health-related physical fitness (HRPF) was determined by measuring participants' cardiorespiratory endurance, muscle strength and endurance, and flexibility using standardized tests (EUROFIT, 1988; Australian Sports Commission, 1999). Cardiovascular endurance was assessed with the 20-metre shuttle run test which is a valid test of aerobic capacity in adolescents (Davis, 2006). The following health-related fitness test items were measured according to the EUROFIT (1988) test protocol: sit and reach (SAR) (a test of hamstring flexibility, expressed in centimetres); sit-up (SUP) (a measure of abdominal strength and endurance, determined by correctly performed sit-ups in 30 seconds); standing broad jump (SBJ) (a test of explosive strength of leg extensors measured in centimetres) and bent arm hang (BAH) (which measures functional arm and shoulder muscular endurance to exhaustion in seconds).

### *Measurement of physical activity (PA)*

PA was assessed using the short form of the International Physical Activity Questionnaire (IPAQ) (CDC, 2002; WHO, 2002; WHO, 2009), which is a valid and reliable tool for assessing PA (Craig, Marshall, Sjostrom, Bauman, Booth, Ainsworth, Pratt, Yngve & Sallis, 2003). IPAQ is considered suitable for use by adolescents at different settings (WHO, 2002) and its short form consists of seven items which identify the frequency and time spent in walking and engaging in other moderate-to-vigorous intensity PA during the seven days prior to questionnaire administration. In the IPAQ only those sessions which lasted 10 minutes or more were analysed. All types of PA related to occupation, transportation, household chores and leisure time activity were included. IPAQ also elicits information about time spent sitting, which is used as an indicator of inactivity.

### *Measurements procedures*

Prior to data collection, permission to conduct the measurements was granted by the District Manager of the Department of Education in Potchefstroom, North West Province. In addition, clearance was received from the Ethics Committee of North-West University, Potchefstroom Campus (Ethics no: NWU-0058-01-A1). The participating schools were briefed about the purpose of the study, and the informed consent forms were signed by the school authorities as well as the learners and their parents. To minimise loss of interest and fatigue among the participants and prevent disruption of teaching and learning activities at the schools, data were collected on days agreed by the participating schools. Only the data of learners who were 14 years old as at the time of testing were analysed.

Before the anthropometric and HRF measurements were carried out, the IPAQ was administered to the participants who were assembled in a classroom, under the supervision of the principal investigator. In completing the IPAQ adequate instructions and clarifications, with no time limit set for completion, were given to the students who subsequently filled the questionnaires independently, without interference from fellow classmates.

The physical and physiological variables were measured in the following order: anthropometry; health-related fitness, gross and fine motor fitness. All anthropometric sites were measured twice according to standard procedures by Level 2 ISAK certified Anthropometrists.

### Statistical analysis

The cross-sectional data on health-related fitness, body composition and PA were analysed using descriptive statistics, such as means and standard deviations. Independent *t*-tests were computed to determine age, and gender differences in the variables among the participants. Non-parametric t-test was used to examine for significant differences between two ordinal variables and Mann-Whitney U test for assess differences between categorical variables. All data analyses were performed with Statistical Package for the Social Sciences (SPSS), version 20.0 programme (SPSS Inc., 2011).

### Results

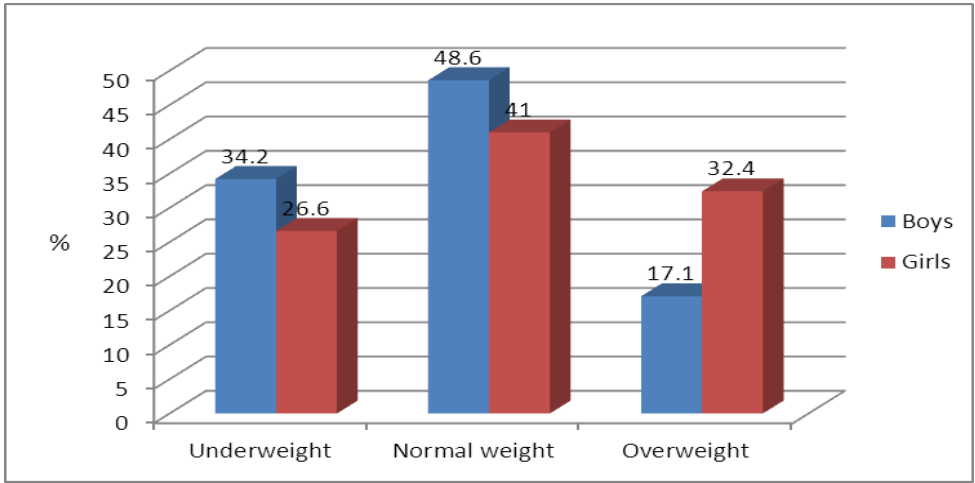
Sex differences in the anthropometric and body composition characteristics of the adolescent learners are presented in Table 1.

**Table 1:** Sex differences in adolescents' anthropometric and body composition characteristics

Anthropometric and body composition measurements	Males (n=111)		Females (n=172)		P-values
	Mean	SD	Mean	SD	
Age	14.90	0.72	14.88	0.82	0.88
Stature (cm)	165.41	9.55	157.88	6.94	<0.000
Body weight (kg)	55.30	13.77	53.70	12.86	0.29
BMI (kg/m <sup>2</sup> )	20.01	3.71	21.43	4.37	0.002
Triceps skinfolds (mm)	9.98	5.08	17.52	6.82	0.00
Subscapular skinfolds (mm)	8.83	4.69	14.02	8.09	<0.000
Sum of skinfolds	18.81	9.49	31.54	14.20	<0.000
% Body fat	13.19	8.56	26.01	8.51	<0.000
Waist circumference (WC) (cm)	68.11	8.29	67.62	8.67	0.51
Hip circumference (cm)	85.29	9.41	92.54	9.81	<0.000
Waist-to-hip ratio (WHR)	0.80	0.3	0.73	0.04	<0.000

SD = standard deviation; p<0.05

On average, the boys (165.41±9.55cm) were significantly taller than the girls (157.88±6.94cm) (p<0.000). Although the boys (55.30±13.77kg) were heavier than the girls (53.70±12.86kg), the difference was not statistically significant (p=0.29). However, despite that the girls (21.43±4.37 kg/m<sup>2</sup>) had a slightly higher BMI than the boys (20.01±3.71kg/m<sup>2</sup>), the difference was significant (p=0.002). When the students were categorised based on their BMI scores the girls were more overweight (32.4%) than the boys (17.1%). However, the boys (34.2%) were generally more underweight than the boys (26.6%) (Figure 1).



**Figure 1:** Percentage scores for boys' and girls' BMI categories

Data presented in Table 1 also indicate that the girls were substantially fatter than the boys ( $p < 0.000$ ); having consistently higher triceps ( $17.52 \pm 6.82\text{mm}$ ), subscapular ( $14.02 \pm 8.09\text{mm}$ ) skinfolds, sum of skinfolds ( $31.54 \pm 14.20\text{mm}$ ) and % body fat ( $26.01 \pm 8.51\%$ ) compared to the boys whose corresponding values were  $9.98 \pm 5.08\text{mm}$ ;  $8.83 \pm 4.69\text{mm}$ ;  $18.81 \pm 9.49\text{mm}$  and  $13.19 \pm 8.56\%$ , respectively. While the participants had comparable WCs, the adolescent girls had higher hip circumference ( $92.54 \pm 9.81\text{cm}$ ) but lower WHR ratio ( $0.73 \pm 0.04$ ) in contrast to the boys ( $85.29 \pm 9.41\text{cm}$  and  $0.80 \pm 0.3$ , respectively). These differences were statistically significant ( $p < 0.000$ ).

Presented in Table 2 are the participants' HRPF scores in which sex differences are also highlighted. The results indicated that the boys had consistently performed better in all the health-related fitness tests than the girls, except that the girls were significantly ( $p < 0.000$ ) flexible than the boys.

**Table 2:** Sex differences in adolescents' health-related physical fitness data

Physical activity	Males		Females		P-values
	Mean	SD	Mean	SD	
SBJ (cm)	186.04	26.07	147.93	19.99	<0.000
BAH (sec.)	18.22	13.53	4.03	5.48	<0.000
SUP (no/30secs.)	35.44	6.97	23.43	10.17	<0.000
SAR (cm)	42.22	9.12	48.51	7.34	<0.000
20m multistage shuttle run	7.94	2.01	4.56	1.54	<0.000
VO <sub>2</sub> max (ml/kg.min <sup>-1</sup> )	40.10	6.89	28.33	5.11	<0.000

SD = standard deviation;  $p < 0.05$



The results of the students' HRPF performances, sport participation, TV viewing habits (Tables 3 and 4) and PA involvement (Tables 5 and 6) are presented. Results of the participants' TV viewing habit indicated that overall, 51(18%), 65(23%) and 112(40%) watched TV more than 3 hours, 2-3 hours and less than an hour per day, respectively.

**Table 3:** Percentage scores of TV viewing for total group

Percentage score of TV viewing	N	%
TV Viewing (0-1hour)	112	40.0
TV Viewing (2-3hours)	65	23.0
TV Viewing (>3hours)	51	18.0
Do not know	55	19.0
Total	283	100

n= number of participants; % = percentage

**Table 4:** Percentage scores (%) of TV viewing for boys and girls

Percentage score of TV viewing	Boys		Girls	
	N	%	n	%
TV Viewing 0-1hour	42	38.0	76	44.0
TV Viewing 2-3hours	29	26.0	36	21.0
TV Viewing >3hours	18	16.0	33	19.0
Do not know	22	20.0	28	16.0
Total	111	100	172	100

n= number of participants; % = percentage

When the data were analysed according to sex categories, results indicated that more girls (19%) than boys (16%) watched TV for more than 3 hours daily. Daily TV viewing less than an hour was also more prevalent among the girls (44%) than the boys (38%). A follow-up analysis using Mann-Whitney U test showed a significant gender difference in the participants' sum of weekly TV viewing hours ( $Z= 32.03, p=.00$ ).

The results on PA were also analysed for the entire group (Table 5) and separately for the adolescent boys and girls (Table 6). Analysis of IPAQ group data showed that 85 (30%), 78(27.5%) and 88(31.1%) of the adolescent learners had low, moderate and high PA involvement, respectively.

**Table 5:** Percentage scores of physical activity participation for the total group

Percentage score of PA	N	%
Do not know	32	11.3
Low PA	85	30.0
Moderate PA	78	27.5
High PA	88	31.1
Total	283	100

n= number of participants; % = percentage

**Table 6:** Percentage scores of physical activity participation for boys and girls

Percentage score of PA	Boys		Girls	
	N	%	N	%
Do not know	16	14.4	16	9.3
Low PA	18	16.2	67	39.0
Moderate PA	29	26.1	49	28.5
High PA	48	43.2	40	23.2
Total	111	100	172	100

n= number of participants; % = percentage

Analysis of the findings according to gender categories seems to be consistent with the trend observed with regards to the results on the learners' TV viewing habit. Specifically, a total of 39.0% of the girls had low PA in contrast to only 23.2% who were categorised as having high PA participation. Among the boys however, only 16.2% had low PA involvement, while 43.2% could be categorised as being highly physically active. A follow-up analysis using Mann-Whitney U test indicated a significant gender difference in this regard ( $Z = -4.52$ ,  $p = 0.00$ ).

## Discussion

In this study HRF, PA and body composition characteristics were comparatively evaluated among a sample of adolescent male and female learners in South Africa. Results of the study showed that overall the adolescent girls were substantially more overweight than the boys. Additionally, in terms of adiposity, the girls were substantially fatter than the boys; having consistently higher triceps, subscapular skinfolds, sum of skinfolds and percentage of body fat. The adolescent girls also had higher hip circumference, but lower WHR in contrast to the boys. The mean WHR values for the boys ( $0.80 \pm 0.30$ ) and girls ( $0.73 \pm 0.04$ ) in this study are lower than that reported for a sample of 15-year old obese Egyptian girls ( $0.81 \pm 0.05$ ) living in Cairo (Hassan, Zaki, El-Masry, Mohsen & Elashmawy, 2011), who underwent a 6-month dietary and PA intervention programme. The Egyptian girls also had substantially higher BMI ( $32.30 \pm 3.13 \text{ kg/m}^2$ ) than the learners in this study. Our sample, however, had higher BMI and WC than those reported for black South African children by Zellie, Moss, Kruger and van Rooyen (2010). These authors reported BMI and WC values of 18.0-20.7  $\text{kg/m}^2$  and 64.0-66.3cm, respectively for 15-19 year-old adolescents who underwent a 10-week PA intervention programme.

The findings concerning HRF status indicated that the boys had consistently better performances in all the HRF tests than the girls. Compared with results of a recent South African study, the boys ( $35.44 \pm 6.97$ ) and girls ( $23.43 \pm 10.17$ ) in this study had superior SUP performances than a sample of 14-16 year-old (Boys:  $23.0 \pm 7.3$ ; Girls:  $15.0 \pm 7.5$ ) learners in Mankweng, a semi-urban settlement in Limpopo Province (Toriola, Moselakgomo, Shaw, Goon & Amusa,

2011a). Girls performed better than the boys in back/upper flexibility, and as such these findings are consistent with previous reports that girls are more flexible at all ages than boys with sex differences during adolescent period (Monyeki et al., 2005; Malina et al., 2004). Boys predicted VO<sub>2</sub>max was relatively fair, whilst for girls VO<sub>2</sub>max was poor as compared to the norms for the general population (Shvartz & Reibold, 1990)

The comparatively low HRF scores among the girls could be attributed to their TV viewing habit which indicates that more girls (19%) than boys (16%) watched TV for longer than 3 hours daily and that they had a higher overall weekly TV watching hours. The greater prevalence of PA among the girls may also be a reflection of their IPAQ data in which 39% of them reported having low PA participation.

Participation in PA is important to children's health as well as their growth and development, but studies in many countries have reported a gradual decline in children's participation in PA. In addition to the many reasons which could account for the rising incidence of PI among children and adolescents such as habitual television viewing, prolonged participation in computer video games and reduced opportunities to participate in school-based PA, there are a number of factors that could either undermine or enable children to be physically active. One of such factors related to the present study is the fact that Physical Education is neglected in many schools, which do not have standard sport facilities that could have provided the opportunity for learners to develop physically active lifestyles (Reddy et al., 2003; van Deventer, 2008).

The relatively low PA levels found among the learners in this study is consistent with widely reported tendency toward decline in PA among adolescents that is often associated with sedentary lifestyle (Telama & Yang 2000); in which many teenagers no longer meet established recommendations for daily moderate-to-vigorous PA (Strong et al., 2005). For instance, Biddle, Gorely and Stensel (2004) also reported a decline in PA among pre-adolescent and adolescent boys and girls.

In addition to sedentary lifestyle and indulgence in other health-risk behaviours, European children's PA level has been associated with living conditions and socio-economic status, peer-pressure and the degree of parental PA involvement (Humbert, Brunner, Spink, Muhajarine, Anderson & Gryba, 2008). Sallis, McKenzie, Alcaraz, Faucette & Novell (1997) have also pointed out that the key determinants of PA are demographic factors (greater likelihood of activity in younger people, especially boys), social factors (encouragement from peers and parents) psychological factors (perceived competence and enjoyment) and the physical environment (availability of different facilities).

The gender difference on PA observed in the present study is not surprising as other studies have also reported the tendency for adolescent girls to be less physically active than boys. For example, studies carried out in Australia have shown that boys (below 15 years) are more likely to participate in PA than girls of similar age category (Salmon, Telford & Crawford 2004; Trost 2005). Similar trends have also been reported in South Africa (Toriola et al., 2011b) and Poland (Czyz & Toriola, 2012) in which adolescent girls showed somewhat negative attitudes towards Physical Education and school sport compared to their male peers.

A number of studies have reported compelling evidence supporting the view that regular PA in adolescence contributes to the development of healthy adult lifestyles by reducing chronic disease incidence (Hallal, Victoria, Azevedo & Wells, 2006), and yielding beneficial health outcomes which are carried over into adulthood (Hallal et al., 2006; Jonker, De Laet, Franco, Peeters, Mackenbach & Nusselder, 2006). In contrast, a low PA level is associated with a higher mortality rate, risk concerning certain types of cancer, obesity, decreased mental health, diabetes, hypertension and a poor quality of life (Andreasi et al., 2010).

Body composition is an important indicator of health status in children and adolescents because maintaining a healthy body composition prevents the onset of obesity which is associated with the risk of cardiovascular diseases, diabetes and stroke (Fukuyama, Inaoka, Matsumura, Yamauch, Natsuhara, Kimura & Ohtsuka, 2005). It has also been suggested that excessive development of fat in childhood or adolescence may cause adverse health problems later in life (Janz, Dawson & Mahoney, 2000). Since childhood and adolescence represent critical developmental stages, enabling environment and opportunities should be created so that they can adopt physically healthy lifestyle and develop life-long positive attitudes towards PA (Dzewaltski, Estabrooks & Johnston, 2002). This can be achieved through community-based partnerships which will facilitate development of effective and sustainable PA intervention programmes in schools.

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