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The status of physical activity, body composition, health-related fitness and social correlates of physical activity among adolescents: The PAHL Study

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Abstract

Research has shown that social correlates of physical activity play an important role in individual participation in physical activity or sport, and hence their link with associated health benefits. The purpose of this study was to determine the status of physical activity (PA), body composition, health-related fitness and social correlates of physical activity among adolescents attending high schools in the Tlokwe Local Municipality of the North West Province. A cross-sectional study design was followed on a total of 284 (111 boys and 173 girls) adolescents with the mean age of 14.90±0.72, who are part of the Physical Activity and Health Longitudinal Study (PAHLS). Height, weight, skinfold thickness (triceps, subscapular and calf) and waist circumferences were measured through the standard procedures described by the International Standard of Advancement of Kinanthropometry (ISAK). Body mass index (BMI), waist-to-height ratio (WtHR) and percentage body fat (%BF) were used as measures of body composition. Health-related physical fitness (HRPF) was determined by measuring cardio-respiratory endurance, muscle strength and endurance, and flexibility using standardised tests test protocols. The standardised International Physical Activity Questionnaire (IPAQ-Short form) and Social Support for Physical Activity questionnaire were used to gather information on physical activity and social correlates for physical activity, respectively. The results show that 29% of the 284 participants are underweight and 26% overweight. 34% of boys were underweight and 17% were overweight while 27% of girls were underweight and 32% overweight. Boys significantly ($p<0.05$) performed better than girls in health-related fitness of standing broad jump, bent arm hang, sit ups and VO_{2max}, except for sit and reach. Out of 284 participants, 34% participated in low physical activity and 35% in high physical activity. For the total group, 36% indicated that they never have someone who provides them with transportation to a place where they can do physical activities or play sports. About 19% of the participants never had friends who tell them that they are doing a good job at physical activity, 18.6% indicated their friends never encourage them to do physical activities or play sport, 15% never have someone to encourage them to do physical activities or sports; 14% never have someone watch them participate in physical activities or sports; and 12% never have someone tell them that they are doing well in physical activity. Overall, lack of social support to participate in physical activity in girls ranged from 11% to 54% as compared to boys 5% to 26%. Adolescent boys were underweight and highly active as compared to relatively overweight and inactive girls. One week PA participation among adolescents' is affected by many contrasts with the percentages in the never ranging from 8% to 36% (of which lack of transportation to the PA facilities was high 36%). Boys have high social correlates to participate in PA as compared to the girls. Urgent strategic public health interventions by all stakeholders dealing with adolescents as well as more research studies in the area are required.

Keywords: Physical activity, sport, health-related fitness, social support, correlates, adolescents.

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Introduction

Research has shown that social correlates of physical activity play an important role in individual participation in physical activity or sport, and hence their link with associated health benefits (Sallis, Prochaska & Taylor, 2000; Sallis et al., 2002). The World Health Organization (WHO) (2009) states that globally around 31% of adults aged 15 and over are insufficiently active (men 28% and women 34%). As a result, approximately 3.2 million deaths each year are attributable to insufficient physical activity (Mozaffarian et al., 2012). The poor health status may increase the risk for dying prematurely of heart disease, and developing breast or colon cancer (Kesaniemi et al., 2001; Horn et al., 2008). The health problem is not limited to adults. In children, physical inactivity is one of the leading factors in childhood obesity which has psychological consequences including low self-esteem, depression, and body dissatisfaction (Antonogeorgos et al., 2010).

South Africa is not different to the global picture in terms of physical activity in the sense that 2003 data on physical activity, as part of the World Health Survey, reported that less than one third of South Africans met the American College of Sport Medicine (ACSM, 2010) and Centers for Disease Control (CDC) recommended physical activity levels with 46% been inactive (Steyn, Fourie & Temple, 2006). The South African Youth Risk Behaviour Study of 2008 reported that 38% of the youth participated in insufficient or no physical activity (within the past week) while 25% reported that they watch TV for more than 3 hours per day (Reddy et al., 2012). Joubert et al. (2007) also found that 30% of ischaemic heart disease, 27% of colon cancer, 22% of ischaemic stroke, 20% of type 2 diabetes and 17% of breast cancer could be attributed to physical inactivity among South African adults. The study estimated that 3.3% of all deaths in 2000 could be attributed to physical inactivity. Physical inactivity thus ranked 9th in terms of attributable deaths compared with other risk factors among South African adults.

Physical activity has been shown to decrease with age in children. Among girls, in particular, participation in leisure time physical activity has been shown to decline by about 45% between ages 12 and 17 with a sharp decline in early adolescence. Physical activity has been found to decline at the ages of 11–12

(Neissar & Raudsepp, 2011) with sexual maturation and objectified body consciousness among adolescents associated with lower participation in physical activity (Visagurskiene et al., 2012).

Janauskas (2013) study conducted on Lithuanian students, reports that laziness, not having enough time, being dissatisfied with sports facilities, having an insufficient choice of sport clubs and unwillingness to participate in sport as reasons for physical inactivity among the students. In Kenya, it was found that urbanisation has led to decreasing levels of physical activity partly due to insufficient leisure time physical activity and an increase in sedentary behaviour during occupational and domestic activities (Ojiambo et al., 2012). In South Africa, the demise of school sport and the lack of sporting facilities especially in black schools have also contributed to physical inactivity amongst children and youth (Sport and Recreation South Africa: National Sport and Recreation Plan, 2011). Dwyer et al. (2006) indicated that lack of time, involvement in technology-related activities, peer influence, parents and teachers, safety concerns, inaccessibility of facilities and the cost thereof, competition, and body-centeredness impeded adolescent girls from participating in sport. Shirinde, Monyeki, Pienaar and Toriola (2012) examined physical activity specifically among South African children attending farm schools and found that the majority of respondents cited lack of time, the demands of work or school work and lack of skills as the major determinants of physical inactivity.

Koorts et al. (2011) showed that a physically active childhood leads to higher physical activity levels in adulthood and that activity in adolescence predicted activity in adulthood in both males and females. The risk for adult inactivity has also been demonstrated to be significantly lower for those who were physically active in adolescence (Huotari, Nupponen, Mikkelsson, Laakso & Kujala, 2011).

In adolescence, specifically, it has been documented (Hallal, Victora, Azevedo & Wells, 2006) that physical activity provides long-term benefits of bone strength, decreased risk of breast cancer, and sedentary behaviours. It has also been found that a higher frequency of participation in physical activity is associated with less depression and anxiety and higher self-esteem (Moksnes, Moljord, Espnes & Byrne, 2010). Physical activity has also been shown to have mental health benefits in adolescence. Physical activity reduces depression and anxiety, increases self-esteem and improves cognitive functioning in children and adolescents (Biddle & Asare, 2011). Bauman et al. (2012) have shown that correlates of physical activity such as age, sex, health status, self-efficacy, and motivation are associated with physical activity. The physical environment was also included by Bungum, Landers, Azzarelli and Moonie (2012) as a contributor to physical inactivity with contributors as urban planning, transportation systems, and parks and trails. Physical activity, in addition to energy expenditure, results

in improvements in the 5 dimensions of health-related physical fitness of cardio-respiratory fitness, musculoskeletal fitness, flexibility, balance and coordination, and body composition (Gabriel, Morrow & Woolsey, 2012). Kaminska, Mihailova and Bernane (2012) found that physical activity duration and physical activity level have an effect on health-related physical fitness components of waist-to-hip ratio, muscle mass, hamstring muscle flexibility, grip strength and VO_{2max}.

The social environment has also been shown to have a positive correlation with participation in physical activity among adolescents (Hsu et al., 2011). Martin-Matillas et al. (2012) conducted the HELENA study in 10 cities from nine European countries in 2006–2008 where the relationship between relatives' (father, mother, brother, sister, and best friend) physical activity participation and encouragement on adolescents' physical fitness was examined. It was found that relatives' physical activity participation was positively related to physical fitness, cardio-respiratory fitness and higher muscular strength in adolescents.

Davison (2009) showed that parents reported community-based, interpersonal, and intrapersonal barriers to supporting their children's physical activity. The most reported barriers included the importance of children's academic performance, a lack of facilities, and concerns about the children's safety. Parents who reported greater barriers also reported lower support for their children's physical activity. In the United States, the neighborhoods' socio-economic status was also found to contribute to participation in physical activity where lower parental education and higher levels of social deprivation were found to be associated with higher BMI in adolescent girls (Voorhees et al., 2009).

In spite of the health benefits associated with physical activity, many children do not meet the daily guidelines of being active for at least 30 minutes a day (Draper et al., 2014). The article which deals with the combination regarding the status of physical activity, body composition, health-related fitness and social correlates of physical activity among adolescents amongst the youth of Tlokwe municipality is not known. The purpose of this study was, therefore, to determine the status of physical activity, body composition and social correlates of physical activity among adolescents attending schools in the Tlokwe Local Municipality of the North West Province.

Methodology

Design and subjects

The Physical Activity and Health Longitudinal Study (PAHLS) is an observational multidisciplinary longitudinal design that started in 2010 with a

group of 312 boys and girls from six secondary schools (two in Potchefstroom town and four in Ikageng Township (Monyeki et al., 2012). The included schools in the study are from the high socio-economic (Town) and low socio-economic (Township) status. This article presents the findings on the cross-sectional (2011) data on 111 boys and 173 girls. More details of the PAHL study are described elsewhere (Monyeki et al., 2012).

Anthropometric measurements

Anthropometric measurements of height, weight, skinfolds thickness (triceps, subscapular and calf), and waist circumferences were measured as described by the International Standard of Advancement of Kinanthropometry (Norton & Olds, 1996). BMI as a measure of body composition was calculated as body mass/stature² (kg/m²). Waist to height ratio was calculated as waist divided by height. Percentage body fat was derived from skinfolds measurements according to the equation developed by Slaughter et al. (1988).

Health-related physical fitness measurements

Health-related physical fitness (HRPF) was determined by measuring participants' cardio-respiratory endurance, muscle strength and endurance, and flexibility using standardized tests (EUROFIT, 1988). Cardio-respiratory 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).

Physical activity

Physical activity was assessed by the use of the short form International Physical Activity Questionnaire (IPAQ) (CDC, 2002; WHO, 2002; WHO, 2009). The *IPAQ questionnaire* is a valid and reliable tool for assessing physical activity (Craig et al., 2003). The questionnaire is comprised of 7 questions which ask the participants about the frequency and time spent sitting, walking and moderate-to-vigorous intensity physical activity (including physical activity related to occupation, transportation, household chores and leisure time activity) in the last 7 days. Only those sessions which lasted ten minutes or more were analysed.

Social Support for Physical Activity

A standardised questionnaire on the Social Support for Physical Activity was used to gather information on social correlates for physical activity (Sallis *et al.,* 2002). The Social Support for Physical Activity Scale included nine (9) statements rated on a 3-point Likert-type scale (*i.e.* Never; Sometimes and Every day). The questionnaire requested the participants to answer the question, "*during a week:* 1. how often do you encourage your friend to do physical activity or play sports?; 2. how often do your friends encourage you to do physical activity or sports?; 3. how often do your friends do physical activities or play sport with you?; 4. how often do your friends tell you that you are doing a good job at physical activity?; 5. has someone encouraged you to do physical activities or sports?; 6. has someone done a physical activity or played sports with you?; 7. has someone provided transportation to a place where you can do physical activities or play sports?; 8. has someone watched you participate in physical activities of sports?; and 9. has someone told you that you are doing well in physical activity? The participants were requested to choose their answer by a mark or a cross next to either never, sometimes and every day.

Statistical analyses

Descriptive statistics (frequencies, means and standard deviation) were determined by the use of the Statistical Package for Social Sciences (SPSS) programme. Differences of continuous variables were determined by the use of an independent *t*–test and one way analyses of variances. For the differences for continuous variable a Chi-square was used. The p-value for significance was set at ≤ 0.05.

Results

Figure 1, presents the percentages of BMI categories for the total group (111 boys and 173 girls). About 29% out of 284 participants were underweight and 26% were overweight.

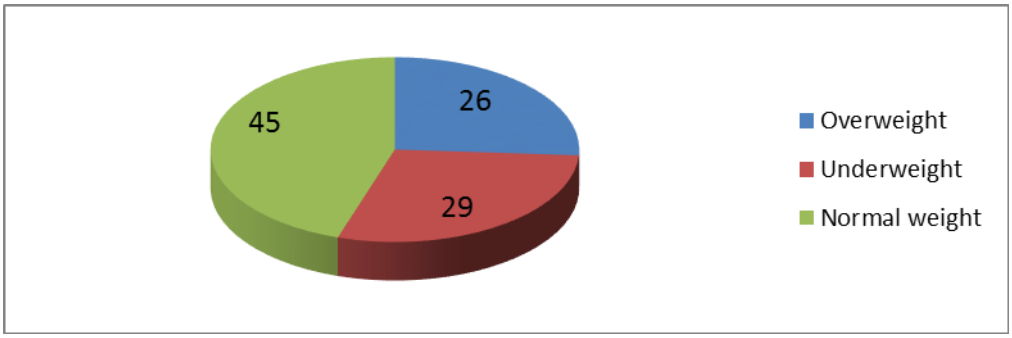

Figure 1: Percentage (%) of BMI categories for the total group

Body composition and health-related fitness

With regard to gender, 34% of boys were underweight and 17% were overweight while 27% of girls were underweight and 32% overweight (Figure 2).

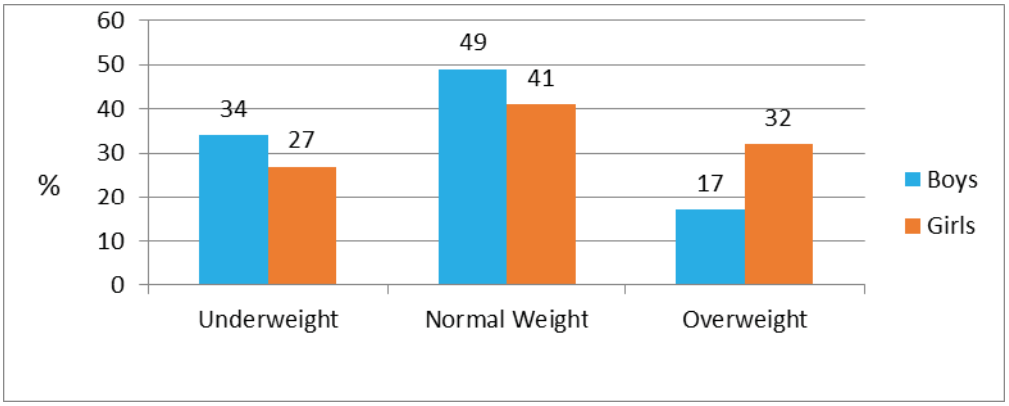

Figure 2: Percentage (%) scores for boys and girls by BMI categories

Table 1, presents the body composition and health-related fitness for the total group. The maximum value for BMI is 38.65 (mean=20.88); %BF 54.47 (mean=20.10); WC maximum 106.2 (mean=67.81) and WHR 0.90 (mean=0.76). For the health related fitness measures, the maximum value for SBJ is 280 (mean=164.55); BAH maximum 74 (mean=9.4); SUP maximum 64 (mean=28.38); VO_{2max} maximum 53 (mean=33.14) and SAR maximum 67 (mean=45.86).

Table 1: Descriptive characteristics (mean and SD) for body composition and health-related fitness

Variables	N	Minimum	Maximum	Mean	SD
Stature (cm)	284	139.60	192.30	160.83	8.85
Body mass (kg)	284	21.0	110.3	54.33	13.22
BMI	284	13.22	38.65	20.88	4.17
%BF	284	3.60	54.47	20.10	10.57
WC	284	52.30	106.20	67.81	8.51
WHR	284	0.63	0.90	0.76	0.05
SBJ (cm)	284	100	280	164.55	29.02
BAH (sec.)	284	0	74	9.40	11.32
SUP (sec)	284	0	64	28.38	11.02
VO_{2max}	284	20	53	33.14	8.27
SAR (cm)	284	19	67	45.86	8.49

BMI= body mass index; %BF=percentage body fat; WC= waist circumference; WHR = waist to height ratio; SBJ = standing broad jump; BAH = bent arm hang; SUP = sit ups; SAR = sit and reach

Table 2 presents the body composition and the health-related fitness profile differences between boys and girls. Girls are significantly ($p<0.05$) fatter (%BF and BMI) and shorter than the boys. A non-significant difference was also found in waist circumference. A significant gender difference ($p<0.05$) was observed in

WHR. Boys significantly ($p<0.05$) performed better than girls in health-related fitness of standing broad jump, bent arm hang, sit ups and $VO_{2max.}$ Girls were significantly ($p<0.05$) more flexible (SAR) compared to boys.

Table 2: Characteristics of body composition health-related fitness and differences for boys and girls

Variables	Gender	Mean	SD	P value of the gender differences
Stature (cm)	Boys	165.41	9.55	<0.00
	Girls	157.89	6.95	
Body mass (kg)	Boys	55.30	13.77	0.33
	Girls	53.70	12.86	
BMI (kg/m^2)	Boys	20.01	3.71	0.003
	Girls	21.43	4.37	
%BF	Boys	13.19	8.55	<0.00
	Girls	26.01	8.51	
WC (cm)	Boys	68.11	8.29	0.64
	Girls	67.62	8.67	
WHR	Boys	0.80	0.03	<0.00
	Girls	0.73	0.04	
SBJ (cm)	Boys	186.04	26.07	<0.00
	Girls	147.93	19.99	
BAH (sec.)	Boys	18.22	13.53	<0.00
	Girls	4.03	5.48	
SUP (sec)	Boys	35.44	6.97	<0.00
	Girls	23.43	10.17	
VO_{2max}	Boys	40.10	6.89	<0.00
	Girls	28.33	5.11	
SAR (cm)	Boys	42.22	9.12	<0.00
	Girls	48.51	7.34	

BMI= body mass index; %BF=percentage body fat; WC= waist circumference; WHR = waist to height ratio; SBJ = standing broad jump; BAH = bent arm hang; SUP = sit ups; SAR = sit and reach

Physical Activity

Figure 3, presents the physical activity for the total group. The results show that out of the total group (n=284), 34% participated in low physical activity with 35% in high PA.

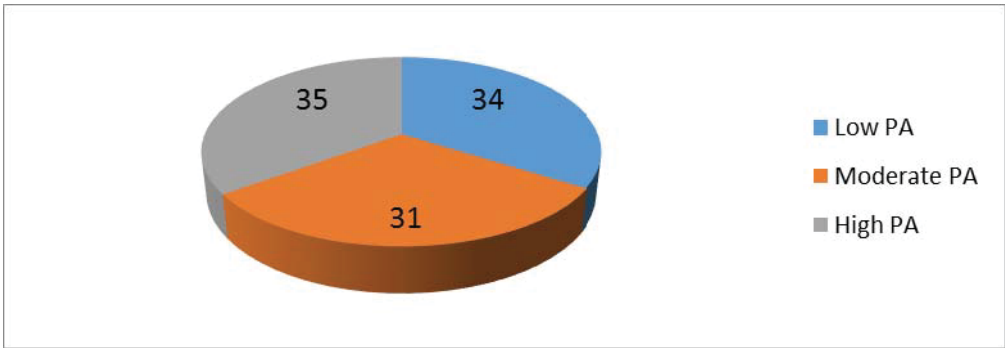

Figure 3: Percentage (%) scores for physical activity for the total group by physical activity categories

Figure 4 presents the PA distribution by gender. The results show that boys were highly active as compared to the girls.

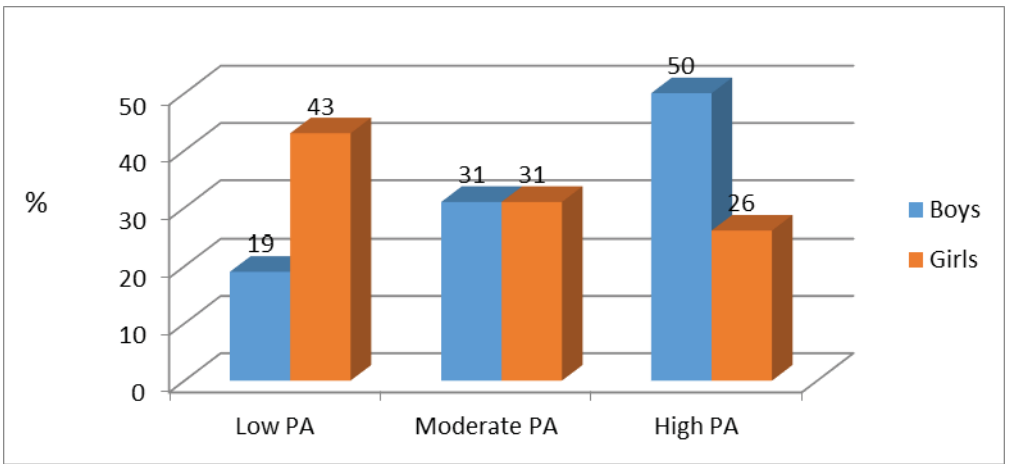

Figure 4 Percentage (%) scores for physical activity for boys and girls by physical activity categories

Social correlates of physical activity

Table 3, presents the results on the social correlates of PA for the total group during a week. For the total group, 36% indicated that they never have someone who provides them with transportation to a place where they can do physical activities or play sports.

Table 3: Percentage (%) social correlates of PA for the total group (n=237)

Social correlates variables (1–9) During a week,	Never		Sometimes		Everyday	
	n	%	n	%	n	%
1. How often do you encourage your friend to do physical activity or play sports?	19	8.01	157	66.2	61	25.7
2. How often do your friends encourage you to do physical activity or sports?	44	18.6	138	58.5	54	22.9
3. How often do your friends do physical activities or play sport with you?	22	9.4	111	47.2	102	43.4
4. How often do your friends tell you that you are doing a good job at physical activity?	45	19.2	118	50.4	71	30.3
5. Has someone encouraged you to do physical activities or sports?	37	15	120	51	80	34
6. Has someone done a physical activity or played sports with you?	25	10.5	122	51.5	90	38
7. Has someone provided transportation to a place where you can do physical activities or play sports?	86	36	101	43	50	21
8. Has someone watched you participate in physical activities of sports?	32	14	114	48	90	38
9. Has someone told you that you are doing well in physical activity?	22	12	118	50	90	38

About 19% of the participants indicated that they never have friends who tell them that they are doing a good job at physical activity, followed by 18.6% who indicated that their friends never encourage them to do physical activities or play sport, 15% never have someone encourage them to do physical activities or sports; 14% never have someone watch them participate in physical activities or sports; and 12% never have someone tell them that they are doing well in physical activity.

Table 4, presents the percentage social correlates of PA during a week by gender. Girls indicated a high percentage for never (24%) regarding encouragement from friends to do physical activity or sport as compared to boys (8%). Furthermore, the results show that girls have a high percentage for never (12.1%) compared to (6%) boys in terms of friends who do physical activity or do sport with them. Additionally, the results show that girls (24%) as compared to boys (12%) never have friends who tell them that they are doing a good job in physical activity or sport. The results further indicated that girls (39%) and boys (30%) do not have someone who provides transportation to a place where they can do physical activities or play sport.

Table 4: Percentage (%) social correlates of PA by gender

Social correlates variables (1–9)		Never		Sometimes		Everyday	
		n	%	n	%	n	%
During a week							
1. How often do you encourage your friend to	Males	7	8	50	57.5	30	34.5
do physical activity or play sports?	Females	11	7.9	98	70.0	31	22.1
2. How often do your friends encourage you to	Males	7	8	55	62.5	26	29.5
do physical activity or sports?	Females	33	23.6	8.	57.1	27	19.3
3. How often do your friends do physical	Males	5	5.7	35	40.2	47	54
activities or play sport with you?	Females	17	12.1	72	51.4	51	36.4
4. how often do your friends tell you that you	Males	10	11.5	41	47.1	36	41.4
are doing a good job at physical activity?	Females	34	24.3	73	52.1	33	23.6
5. Has someone encouraged you to do physical	Males	13	14.9	45	51.7	29	33.3
activities or sports?	Females	19	13.6	71	50.7	50	35.7
6. Has someone done a physical activity or	Males	7	8	39	44.8	41	47.1
played sports with you?	Females	11	7.9	82	58.6	47	33.6
7. Has someone provided transportation to a	Males	26	29.9	39	44.8	22	25.3
place where you can do physical activities or play sports?	Females	54	38.6	60	42.9	26	18.6
8. Has someone watched you participate in	Males	10	11.5	41	47.1	36	41.4
physical activities or sports?	Females	21	15.0	68	48.6	51	36.4
9. Has someone told you that you are doing	Males	9	10.3	41	47.1	37	42.5
well in physical activity?	Females	17	12.1	72	51.4	51	36.4

Discussion

The purpose of this study was to determine the status of physical activity, health-related fitness and social correlates of physical activity among adolescents attending high schools in the Tlokwe Local Municipality of the North West Province. Girls in this present study were found to be significantly fatter (%BF and BMI as a surrogate of fatness) and shorter than the boys.

A significant gender difference was also observed in WHR where boys were found to have a higher WHR than the girls. Boys in the present study were underweight and active as compared to girls who were overweight and inactive. These findings are consistent with the findings of a study on Hong Kong adolescents where girls were found to have higher %BF and BMI than boys (Mak, McManus & Lai, 2013). In the present study boys had significantly high WHR compared to study to girls, and this findings were contrary to Ma et al. (2013) findings on the Hong Kong boys.

The reasons for this contrast findings may be explained by genetic predispositions (no genetic data was collected in the current study) of South African boys compared to the Hong Kong ones. Furthermore, boys significantly performed better than girls ($p<0.05$) in health-related fitness of standing broad jump, bent arm hang, sit ups and $VO_{2max,}$ except for sit and reach. The findings are congruent to those of Martin, Buchan, Kulik, *et al.* (2012) who found higher health-related fitness in boys than girls.

The adolescents in this study had relatively high physical activity participation. These findings are congruent with the recent findings on the same sample by Toriola and Monyeki (2012). When the current findings were compared with other studies in South Africa variations in terms of participation prevailed (Micklesfield et al., 2014).

The reasons for these variations, amongst others, can be explained by the different instruments used to assess physical activity in children (Cain et al., 2013). Our findings are somewhat in line with some findings reported in Mozambican adolescents (Prista, Nhantumbo & Saranga, 2009), Kenyan children (Ojiambo *et al.,* 2012) and Nigerian children (Olubusola, Obembe & Faniran, 2013). Even though the adolescents in the study do not necessarily meet the recommendations of 60 minutes a day, they appear to be physically active than adolescents in developed countries like the USA (Vigo-Valentin, Bush & Hodge, 2014).

It is well known that participation in physical activity is based on the social-ecological model as proposed by Sallis, Owen and Fisher (2008). In our findings, it was apparent that adolescents' participation in physical activity was affected by *'lack of support by friends', 'encouragement by friends or family members' and 'lack of support during engagement in physical activity'*. Similar findings were reported by Serra, Casterad and Generelo (2014) who highlighted *'support from friends'*; and Cheng, Mendonca and Farias (2014) who found parents to be a positive factor, for engaging in physicalactivity.

Dwyer *et al.* (2006) study on adolescent girls' perceived barriers to participation in physical activity, found *'lack of peer influence and parents'* as one of the factors, affecting the non-participation of adolescent girls' in physical activity. In the current study therefore, girls seem to have low friends *'encouragements to participate in sport or physical activity'* as compared to the boys.

Bungum *et al.* (2012) indicated that the physical environment, such as *'lack of transportation'*, affects participation in physical activity. Such a trend was evident in the current study where both boys and girls shared high percentages in terms of *'lack of availability of transportation'* to the place of sport or physical activity. Zhanga, Solmon, Gao and Kosma (2012) reported that 1.1% of variation in physical activity participation is accounted for by the physical environment. In contrast, findings by Xu, Chepyator-Thomson, Liu and Schmidlein (2010) indicated that transportation did not have a strong impact on students' participation in extracurricular physical activity.

Interpretation of these findings needs to be conducted with caution as our sample size cannot be used for generalisation to the adolescent population in the Tlokwe local municipality or to the South African adolescent population. Furthermore, the cross-sectional design of the study may somewhat have affected the interpretation of the results in the sense that some of the aspects/variables change over a period of time.

Regardless of these weaknesses, the strength of the PAHL study is that it is planned for a period of time, where some of the variables will be tracked longitudinally to determine the development over time.

The PAHL study is based on one birth cohort (14 years) that was followed up for a period of five years.

Conclusion

The adolescent boys were underweight and highly active as compared to relatively overweight and inactive girls.

Boys have higher health-related fitness and higher social correlates as compared to the girls. Encouragements from friends or others were found to be a social correlates affecting physical activity and sport participation.

Additionally, transportation played a major role as a correlate to participation in physical activity or sport with 36% of the participants indicating lack of transport as a negative factor for their participation in physical activity and sport. Based on these findings, urgent strategic public health interventions by all stakeholders dealing with adolescents as well as more research studies in the area are required.

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Disclaimer

Any opinion, findings and conclusions or recommendations expressed in this material are those of the author(s), and therefore the NRF and MRC do not accept any liability in this regard.

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