

Physical activity and body composition, a risk profile analysis of learners in selected urban secondary schools in Namibia

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Abstract

Several developing countries around the world are at present undergoing a process of epidemiological transition which is associated with various health problems. The globally enhanced prevalence of obesity and physical inactivity of children is a cause for major concern to health professionals. Very little is known about this phenomenon in Namibia. Therefore the aim of this study was to construct a profile of secondary school learners in selected urban schools in Namibia. This cross-sectional study on a randomly selected secondary school population in Windhoek, capital city of Namibia, included 133 boys and 161 girls aged 14-18 years. Body mass, stature, percentage body fat as well as the youth risk behaviour questionnaire were used to analyse the profile of the participants. Data were analysed, using "Statistics for Windows". The results of this study indicated that for boys, a decrease in the prevalence of overweight occurs from 14-17 years (17% - 5%). However, for the 18-year-old group, 34% tend to be overweight. Except for the 17-year-old boys, the obese group shows a consistent increase, with the 18-year-olds being the most obese (17%). The same tendency occurs in the case of the girls, with the 18-year-olds showing a prevalence of 39% in the obese and overweight categories, respectively. Regarding the physical activity profile, the highest prevalence occurs in the 17-year-old boys (30%) and 17 and 18-year-old girls (35% & 33% respectively). As far as the overweight and obese participants are concerned, most of them were classified as low active (6% boys & 51% girls) respectively)

Key words: Physical activity, overweight, obese, chronic disease, learners.

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Introduction

Several countries around the world are at present undergoing a process of epidemiological transition associated with a variety of health and other consequences (Goedecke, Courtney, Jennings & Lambert, 2006). Some of the major health consequences of this transition process are the decline of sufficient physical activity, a remarkable change in living habits, viz. consumption of excessive amounts of refined sugars and electronic entertainment (Cameron, 2005). This unhealthy situation provides a detrimental basis for the non-communicable diseases, also known as "chronic diseases of lifestyle", responsible for a major part of the health care budget (Steyn, 2006).

The health consequences mentioned are not only limited to the adult population but also affect the young child and the adolescent population, already a cause for great concern among health professionals (Kahn, 2011). In this respect, childhood obesity has already reached pandemic proportions globally (Cameron, 2005; Mota, 2005). Evidence exists that in 2001, 15% of the UK's 15-year-old children were obese with another 20% overweight and in danger of becoming obese in the near future (Cameron, 2005). According to Wang, Monteiro and Popkin (2002), almost 20% of children and adolescents in the USA are reported to be obese. In addition, up to 30% of the girls and 10% of the boys who were obese at youth continue this trend into adulthood resulting in an enhanced prevalence of hypertension, dyslipidaemia and insulin resistance (Mota, 2005; Goedecke *et al.*, 2006). These are all risk factors that may eventually lead to coronary heart disease (AAP, 2006). Other health hazards associated with obesity are *inter alia*: gall bladder disease, orthopaedic problems, sleep apnoea and several social and psychological problems (Gortmaker, Must, Perrin, Sobol & Dietz, 1993; Deckelbaum & Williams, 2001; Must & Strauss, 2002; Ehrman, Gordon, Visich & Keteyian, 2009).

Generally speaking it is assumed that obesity is the result of a positive energy balance where the intake exceeds the expenditure (Cameron, 2005). However, during childhood the association between energy intake and expenditure is more complex, as sufficient energy intake is required for normal growth and development (Cameron, 2005). Hence childhood obesity is a complex clinical condition, but authorities agree that genetic predisposition, physical inactivity, poor dietary choices and an obesogenic environment may all be important role players in this multi-factional condition (Mota, 2005). However, the increasing prevalence of obesity over the past 30 years suggests that environmental and lifestyle factors, rather than genetic predisposition, must be responsible for this rapid increase in overweight and obesity (Kesanieme, Danforth, Jensen, Kopelman, Lefebvre & Reeder, 2001). Furthermore, intra-uterine influences ("intra-uterine programming") may also be linked to various health problems, *viz.* metabolic syndrome (Goedecke, *et al.*, 2006) where obesity was found to be a major role player.

Together with the concern among health professionals regarding the growing epidemic of youth obesity, the decline in physical activity participation also become a major health problem, contributing to the chronic, non-communicable disease epidemic (Bouchard, Blair & Haskell, 2007, YRBS, 2010).

Research indicated that in 2007, 45% of the youth in South Africa reported to participate in sufficient vigorous physical activity, which is considered to be good for their health (Healthy Active Kids, 2007). This figure dropped to 42% in 2010 (Kahn, 2011). In 40% of the children, little or no vigorous physical activity was reported (Healthy Active Kids, 2007). In smaller towns and rural

settings these figures are even worse, since 64% of the girls and 45% of the boys reported little or no moderate physical activity. A matter of concern to health professionals is that this hypokinetic trend is associated with a sedentary “culture”, as 25% of the adolescents reported little or no interest in leisure time activities (Healthy Active Kids, 2007). This situation may result in a vicious cycle where the unhealthy lifestyle of the young population may globally lead to an epidemic of non-communicable diseases, presently already drawing concern from global leaders (Kahn, 2011).

Various researchers have indicated that an increase in physical activity may contribute to the management of obesity (Mota, 2005; AAP, 2006; Gutin, 2008). While physical inactivity appears to be strongly linked to the aetiology of obesity, studies on the effectiveness of physical activity in promoting weight loss have been less encouraging (PCPFS, 2000). This may lead to a situation in which obese and overweight individuals engaging in physical activities in order to lose weight may quickly lose interest and easily return to a hypokinetic culture.

From the discussion above it is clear that great concern exists regarding the increasing epidemic of obesity and physical inactivity among the youth and that efforts to remedy this situation should be enhanced. In this regard various suggestions have already been voiced that the school physical education programme should be streamlined to support this intervention (AAP, 2006).

In order to apply intervention campaigns in various environments, it is imperative to understand the prevalence of the threats aimed to be addressed. Very little, if any, information exists on the prevalence of overweight and obesity in the Namibian school environment. The aim of this study therefore was to determine the body composition and physical activity profile among learners in some selected urbanized Namibian secondary schools.

Methodology

Research design

This study was based on a once-off cross-sectional survey on a randomly selected school population in secondary schools in Windhoek, Namibia. This population includes both gender- and ethnic groupings.

Participants

A total number of 294 learners from 4 secondary schools, selected at random, participated in this study. This cohort represents 129 black, 145 Caucasian and 9 children from other ethnic groupings. The 133 boys and 161 girls representing age groups 14 – 18 years were as follows:

Table1: Distribution of boys and girls in various age groups

Age (year)	Boys (n=133)	Girls (n=161)
14	38	50
15	31	43
16	32	31
17	20	24
18	12	13

Demographic questionnaire

All participants were requested to complete a demographic questionnaire indicating age, gender and ethnic grouping.

Youth Risk Behaviour Survey (YRBS) (2003)

All participants were requested to complete the YRBS questionnaire (2003). For purposes of this study only the part on physical activity (Question 80) was used to stratify the participants by asking them to respond to the following “on how many of the past 7 days did you exercise or participate in physical activity for at least 20 minutes that made you sweat and breath hard, such as basketball, soccer, running, swimming laps, fast cycling, fast dancing, or similar aerobic activities.

The following classification was used in this study (Greeff, 2007), *viz.* Low active = <1 session/day; Moderate activity = 1 – 3 sessions/day; High activity = > 3 sessions/day.

According to the ACSM (2006), individuals training against a frequency of 3-5 days/week at 60% - 80% of HRR (heart rate reserve) (“sweating and breathing hard”) will be sufficient to improve VO₂max and experience health consequences. Deconditioned individuals may also benefit from training 1 – 3 days/week (ACSM, 2006).

Measuring instruments

The following instruments were used in gathering the data.

- **Body Mass**

Body mass was determined by using an electronic scale – measuring the body mass to the nearest 0.1kg. Participants were only allowed to be in underwear, and procedures suggested by Marfell-Jones, Olds, Stewart and Carter (2006) were followed.

- **Stature**

Stature was determined by using a portable stadiometer following the procedure as described by Marfell-Jones *et al.* (2006). Stature was measured to the nearest 0.1 cm with the head in the Frankfort plane.

- **Percentage body fat (%)**

In order to determine the percentage body fat of the participants, the following skinfolds were measured according to Marfell-Jones *et al.* (2006) – triceps, subscapular and calf. To calculate the percentage body fat, the following formulae as suggested by Boileau, Lohman and Slaughter (1985) for the use in children and adults, were used:

Boys (12 – 14 years): % Body fat = $1.35 \times (\text{sum of triceps} + \text{subscapular skinfolds}) - 0.012 \times (\text{sum of triceps} + \text{subscapular skinfolds})^2 - 4.4$

Girls (14 – 15 years): % Body fat = $1.35 \times (\text{sum of triceps} + \text{subscapular skinfolds}) - 0.012 \times (\text{sum of triceps} + \text{subscapular skinfolds})^2 - 3.4$

Boys (15 – 17 years): % fat = $1.35 \times (\text{sum of triceps} + \text{subscapular skinfolds}) - 0.012 \times (\text{sum of triceps} + \text{subscapular skinfolds})^2 - 5.4$

Girls (16 – 18 years): % fat = $1.35 \times (\text{sum of triceps} + \text{subscapular skinfolds}) - 0.012 \times (\text{sum of triceps} + \text{subscapular skinfolds})^2 - 4.0$

The following cut-points of the percentage body fat were used in order to stratify the participants (Boileau *et al.* 1985):

Table 2: Cut-points for percentage body fat for boys and girls

	Boys	Girls
Low	<12%	<15%
Normal	12.1 – 25%	15.1 – 25%
Overweight	25.1 – 30%	25.1 – 30%
Obese	>30%	>30%

Procedure

Once permission for this study had been granted by the Namibian Education Department, the principals of the 4 randomly selected secondary schools in Windhoek were approached to obtain their permission. This was followed by selecting the participants at random and issuing each one with the relevant documentation regarding this study to discuss with their parents/guardians. This included a general outline of the study, objectives and procedures, as well as the informed consent documentation which they had to sign upon agreement. All participants were then informed about the details of the research and could ask any questions.

After collecting all anthropometric data by qualified and registered biokineticists, all questionnaires were completed. The questionnaires were all in English and care was taken that all participants clearly understood the questions.

Statistical analysis

Data were analysed by using the “Statistics for Windows” version 6 software (Statsoft, 2003). Descriptive statistics were used to present the data of boys and girls followed

by two-way frequency analysis to determine the relationship between physical activity and overweight and obesity.

Results

The results of this study are presented in Table 1 as well as in Figures 1-3. From Table 3 it is clear that the body mass and height of the boys increased from 14-18 years. However, both the mean body mass and height of the 16-year-olds show a slightly higher value compared to the 17-year-olds (66.0 kg vs 65.9 kg and 174.0 mm vs 173.2 mm). In the case of the % body fat, a decrease occurred from 14 years to 17 years, followed by an increase to 20% body fat in the 18-year-old group.

In the case of the girls, a constant increase in the mean body mass and height were recorded from 14 – 18 years. As far as the percentage body fat is concerned, an increase occurred from 14 – 16 years, with the 17-year-olds showing a slightly lower percentage body fat (28.0% vs 27.7%), followed by an increase in the percentage body fat (31.1%) in the 18-year-olds.

The body composition profile of the boys and girls is presented in Figure 1, using percentage body fat as the representative parameter. In the case of the boys 14 – 16 years old, the majority fell in the normal range. However, in the 17-year-old group a large percentage (55%) fell in the low category, while for the 18-year-olds, 33% were categorised in the low and normal groups each. Concerning the overweight problem, a decrease occurred between 14 and 17 years (17% - 5%) with an increase in the 18-year-old group (34%). In the obese group, however, the increase was from 3% to 9% (14-16 years), with no reported cases in the 17-year-old group. The 18-year-olds showed the highest prevalence (17%) of obese individuals.

Table 3: Descriptive data of learners in selected Namibian schools

Parameter	Boys										Girls													
	14		15		16		17		18		Total Group		14		15		16		17		18		Total Group	
Age (years)																								
Number	38		31		32		20		12		133		50		43		31		24		13		161	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Body Mass (kg)	53.0	9.4	60.4	11.8	66.0	11.0	65.9	12.8	74.0	14.1	61.8	13.0	52.4	8.6	53.2	10.6	56.8	10.5	58.8	6.7	61.9	15.8	55.2	10.4
Height (cm)	163.7	8.9	173.4	9.9	174.0	7.6	173.2	6.1	176.7	5.4	171.1	9.4	160.4	6.3	161.0	6.0	162.6	6.6	164.5	7.4	166.7	8.4	162.1	6.8
BMI (kg.m ⁻³)	19.7	2.5	20.0	2.9	21.8	3.2	21.9	3.4	28.7	4.3	21.0	3.3	20.3	2.3	20.5	3.7	21.5	3.4	21.7	2.0	22.2	4.6	20.9	3.3
% BF (%)	17.2	6.6	16.4	6.9	16.1	7.6	13.8	4.6	20.0	12.2	16.5	7.4	25.5	6.3	26.0	6.2	28.0	8.0	27.7	5.5	31.1	11.3	26.9	7.1

BMI = Body Mass Index; %BF = Percentage body fat; M = Mean; SD = standard deviation

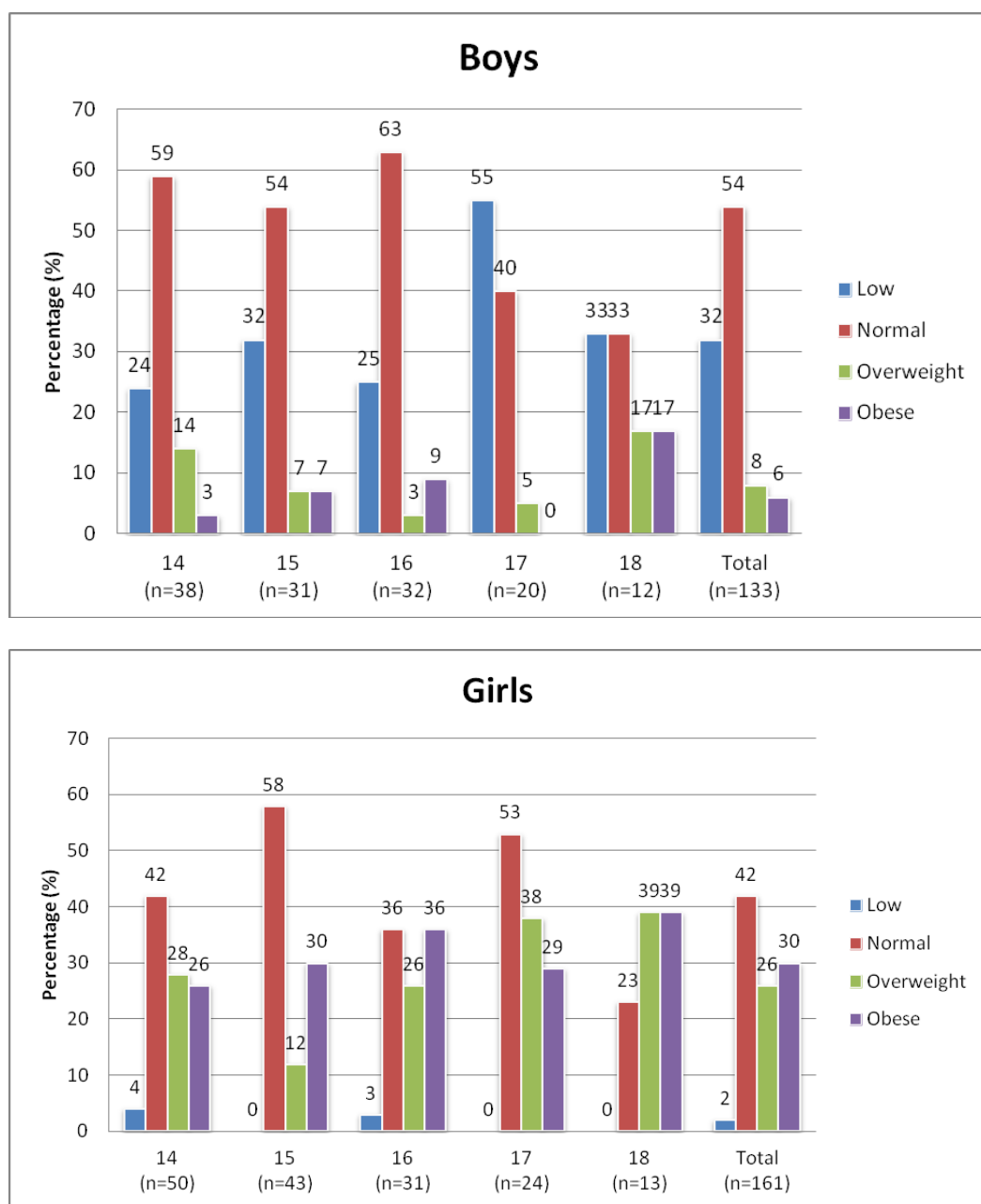


Figure 1: Body composition profile (% body fat) of male and female learners (14-18 years) in selected Namibian Secondary Schools.

For the girls, the pattern totally differs from that of the boys. In the 14 and 18-year-old groups a very small portion was classified in the low category (4% - 0%) (Figure 1). The majority of the learners in the 14 and 15-year-old groups were classified in the normal range of percentage body fat. From 15 – 18 years, a constant decline in the normal category of % body fat occurred from 58% to 23%, while the overweight and obese categories show an increase, up to 39%

prevalence in each of the overweight and obese categories in the 18-year-old girls. In Figure 2 the physical activity participation profile of the learners was analysed.

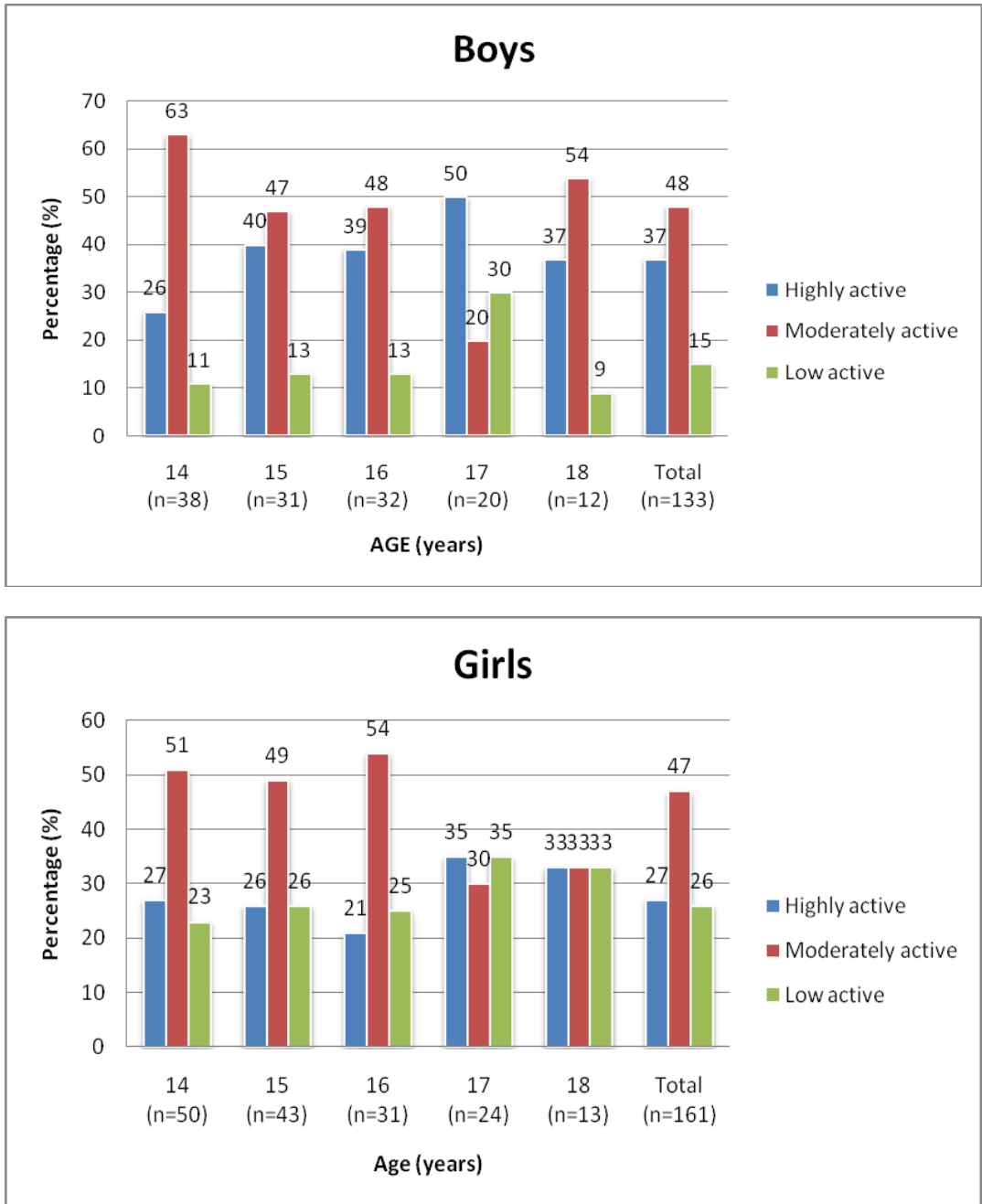
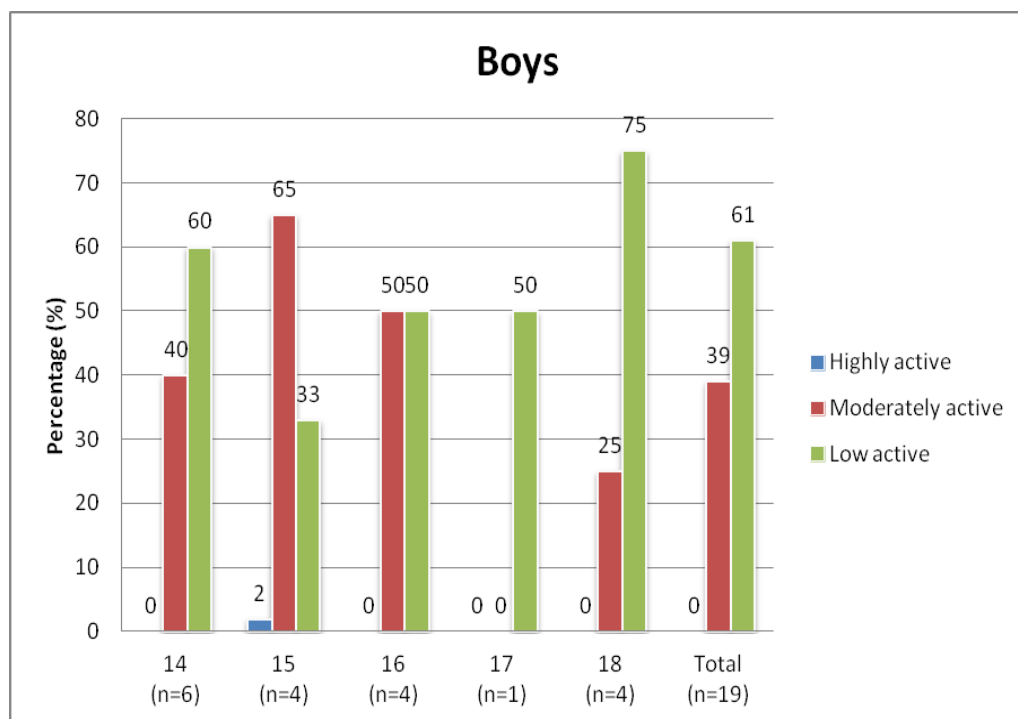


Figure 2: Physical activity participation profile of male and female learners (14-18 years) in selected Namibian Secondary Schools.

It is clear that for the majority of boys in all the age groups, except the 17-year-olds, reported a moderate physically active profile, while the minority reported a low active profile. The rest of the participants indicated a highly active profile. However, for the 17-year-old group 50% reported to be high physically active, while 20% and 30% indicated a moderate and low physically active profile respectively. Looking at the results of the girls, the majority of the 14 to 16-year-olds could be classified as moderately active with the rest of the learners in more or less the same numbers falling in the high and low active categories. In the 17 and 18-year age groups, the learners reported nearly equal numbers of high, moderate and low physical activity participation.

Figure 3 indicate the physical activity profile of the overweight and obese learners (%body fat > 25%).



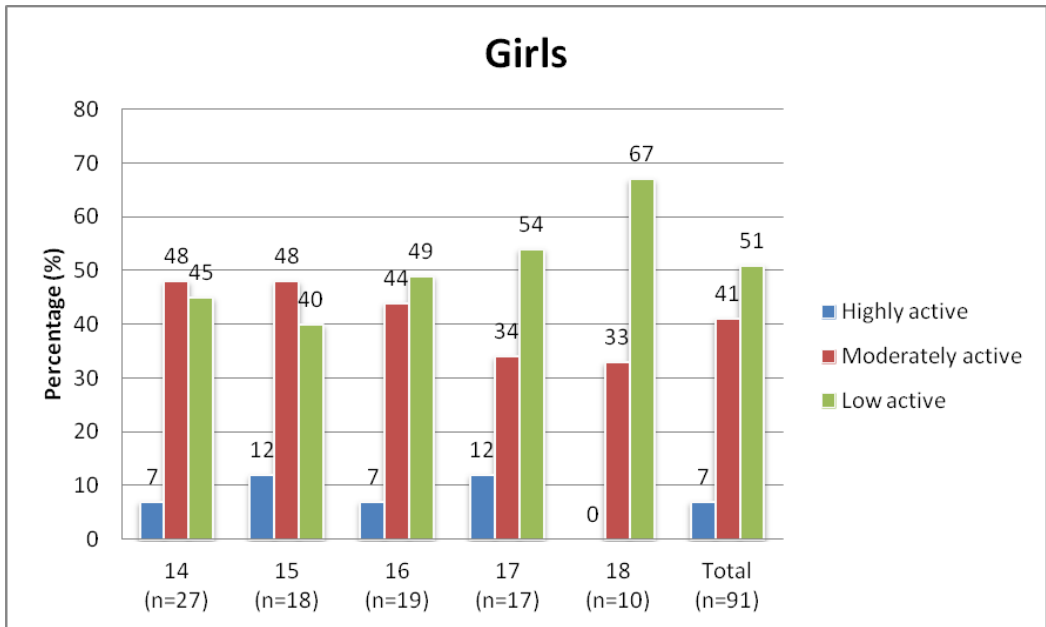


Figure 3: Physical activity participation profile of overweight and obese learners (BF% > 25) in selected Namibian Secondary Schools.

In the case of the boys, the majority of the participants reported a low physical activity participation in all the age groups, except for the 15-year-old ones where 65% of them reported to be moderately active.

In the case of the 14 and 15-year-old overweight and obese girls, 45% and 40% of them reported low physical activity participation, while 48% in both groups fall in the moderately active group. The majority reported to be low physically active, with an increasing tendency from 16 to 18 year, viz. 49%, 54%, 67%. It is interesting to note that except for the 18-year-old girls, all other age groups reported some participants to be highly active.

Discussion

As is the case in other developing countries, the prevalence of overweight and obesity is also present in the urban Namibian school population. This situation is more prominent among the girls than is the case with the boys (Figure 1). In the case of the girls a progressive increase occurred in overweight and obesity from the age of 15, reaching the peak in the 18-year-old group. This may be linked to various reasons, viz. decrease in physical activity participation, change in eating behaviour (Goedecke *et al.*, 2006), sedentary culture (DSR, 2005) onset of menarche (Sherar, Gyurcsik, Humbert, Eslinger & Baxter-Jones, 2009) and safety (AAP, 2006). According to the literature, a considerable portion of the overweight and obese adolescents will continue this trend into adulthood (Mota, 2005), which implies that they may fall victim to the chronic illnesses associated

with obesity (Goedecke *et al.*, 2006) which on their part may place excessive health burdens on the health care cost of the individual as well as the country (Katzmarzyk, 2010). It is suggested in the literature that some of the typical chronic lifestyle diseases of adulthood can already be associated with obesity during adolescence (Rowland, 1990). It is therefore imperative that knowledge regarding the health threats of destructive lifestyles leading to obesity should be communicated efficiently to the youth (school learners) in order to create a change in attitude. In this, the school environment may offer the ideal opportunity as it provides a captive audience. It is also important that the school programme should not only focus on the importance of physical education (physical activity) but on increasing the knowledge and understanding of a healthy lifestyle (Blair & Meredith, 1994). If availing the opportunity to establish this change in attitude at school level fails, a vicious cycle may follow, resulting in a progressive increase in body fat or exposure to various kinds of body mass management and eventually resulting in a new family structure predisposing an unhealthy lifestyle to their offspring. In this regard Bouchard (1994) indicated that approximately 75% of the variation in percentage body fat and total fat was determined by culture and lifestyle, whereas 25% can be attributed to genetic factors.

In developing countries with diverse ethnic groups, socio-cultural factors may also contribute to the prevalence of overweight and obesity (Goedecke *et al.*, 2006). In this regard Mvo, Dick and Steyn (1999) and Clark, Niccolai, Kissinger, Peterson and Bouvier (1999) have shown that an overweight body type has positive connotations within the black South African community (especially the females), symbolizing happiness, beauty, affluence, health and a negative HIV/AIDS status. This again emphasises the critical need for educating the individuals in order to create a change in attitude that will hopefully lead to a healthy lifestyle.

From Figure 2 it is clear that except for the 17-year-old boys, where 50% reported to be highly active, all the other groups reported a moderately active lifestyle. It is also clear that except for the 18-year-old group (boys), a progressive increase in the low active category was reported. For the girls, approximately one third of the learners reported a highly active lifestyle in the 17 and 18-year-old groups, while two thirds reported to be moderately and low active. This high prevalence of physical inactivity may partially be linked to the relatively high prevalence of overweight and obesity of these age groups (17 & 18 years).

Despite the salutogenic effect of regular physical activity (Ehrman *et al.*, 2009), a global increase in sedentariness across the lifespan is a cause for major concern to health professionals. In South Africa, a country undergoing epidemiological

transition, as is the case in most developing countries (Cameron, 2005), recent studies suggested that about 40% of the children and youths are getting little or no moderate to vigorous activity, with the vulnerable groups for inactivity being the girls 16 to 19 years old and children from disadvantaged communities (Healthy Active Kids, 2007). This alarming situation suggests a sedentary “culture” in 25.8% of the youth indicating little or no interest in physical activity and sport participation, followed by 22.2% claiming “no particular reason” for their inactive lifestyle (DSR, 2005). This may be the result of various factors, including personal (exposure to electronic and other entertainment) (Healthy Active Kids, 2007; Kahn, 2011) and environmental (lack of facilities, unsafe) (DSR, 2005) circumstances.

From Figure 3 it is clear that a significant portion of overweight and obese learners reported a low physically active lifestyle. This confirms the association relating physical inactivity to obesity (Thompson, Jarvie, Lahey & Curton, 1982; Rowland, 1990). The reasons for this situation are not clear but may be associated with negative social and psychological factors such as peer aggression, relational withdrawing friendship or spreading rumours and lies, name-calling or teasing, hitting and kicking (Yeung & Hills, 2007).

As in the case of adulthood, a lack of physical activity and obesity during childhood are closely related to various health problems (Rowland, 1990; Mota, 2005; Yeung & Hills, 2007) and should be addressed during these phases of life (AAP, 2006). In this regard, somewhat of a contradiction may complicate this connection. While physical inactivity appears to be a strong contributing factor to the aetiology of obesity, some studies on the effectiveness of physical activity in causing weight loss have been less encouraging (PCPFS, 2000). Hence it is understandable that in the case of the obese adolescents one could quickly lose interest when no results are experienced from a treatment regime of a physical activity intervention with a view to reduce weight. Evidence, however, suggests that physical activity confers health benefits that are entirely independent of changes in body composition (PCPFS, 2000), suggesting that the overweight and obese individual may obtain the same benefits as their lean counterparts (AAP, 2006). What is more important is the fact that physical activity may provide a protective effect on all causes of morbidity and mortality, irrespective of the body composition status of the individual (PCPFS, 2000).

The mechanisms involved in this protective effect may be related to the reduction and/or reversing of the progressive disease process, known as Syndrome X (PCPFS, 2000), which is also related to abdominal fat – particularly visceral fat (PCPFS, 2000, Goedecke *et al.*, 2010). Research has indicated that physical activity leads to specific reduction in levels of abdominal obesity (Ross & Janssen, 1999), resulting in salutogenic changes. This may even occur

without a corresponding weight loss or total fat loss (PCPFS, 2000). Recent results indicated that another important advantage of physical activity in the prevention of obesity is the fact that the genetic predisposition to obesity can be reduced by approximately 40% (Li, Zhao, Luan, Ekelund, Luben, Khan, Warham & Loos, 2010), supporting the evidence that physical activity participation may not only be regarded as a preventative but also as a protective modality to individual health. In the light of this discussion it seems important to educate the large portion of the inactive obese school learners concerning the health-related properties of a physically active lifestyle.

As the children spend most of their time at school, more efforts should be made to emphasize these health threats to the adolescents. Emphasis should be on sharing the knowledge in order to change the attitude of the learners to maintain a lifelong active lifestyle in order to enhance quality of life.

Limitations

In order to construct a comprehensive risk profile of the learners in the secondary schools in Windhoek, Namibia, a number of girls and boys in each age category, 14-18 years, were studied. This on the other hand led to the fact that some groups consisted of relatively small numbers of participants, *viz.* the 18-year-old category for boys and girls, included only 12 and 13 participants respectively. In the further analysis of the various groups, these small numbers may influence the results, and in final interpretation this limitation of the study should always be borne in mind. However, the importance of this study should be viewed against the scarcity of this type of data in the secondary schools in Namibia. Prior to this research, no known study could be found addressing this topic.

Conclusion

From this study it is clear that the majority of the learners in some selected urbanized Namibian schools are suffering from increased percentage body fat. Concurrently a decrease in physical activity is also noted as the learners become older – more so in the case of the girls than the boys. In the case of the overweight and obese learners a small portion of the learners reported a highly active lifestyle.

This situation should be a cause for serious concern to the health and educational professionals of the country as it may impact on severe consequences as far as the population health is concerned as well as on enhancing the burden on health care costs. A possible way of addressing the problem of overweight and obesity is by starting with the school population as it provides a captive audience and the message from the teacher may carry more impact. The revitalising of physical

education, focusing on lifelong physical activities and empowering the learners with appropriate skills and knowledge to evaluate their own health and wellness is imperative.

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