Body composition and television viewing among high school adolescents residing within the Tlokwe municipality: PAHL study

P.M SATHEKGE
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P.M SATHEKGE [22704043]
S.T.D., B.A., B.A. Hons

Dissertation submitted in fulfilment of the requirements for the degree Master of Arts in Biokinetics at the Potchefstroom Campus of the North-West University

Supervisor: Prof. dr. M.A. Monyeki
Co-supervisor: Prof. dr. J.H. De Ridder

November 2012
The power of the God is unmeasurable when coming to this work. His name must be glorified and be honoured.

I will like to sincerely thank my supervisor Professor M.A. Monyeki for his unwavering support to this work. You were my shepherd and brother in this work. There was a time when I lost hope and became disillusioned but your words of encouragement helped me to regain strength and confidence to continue pursuing my goal. Thank you once more and be academically blessed.

The assistance and contribution of my co–supervisor Professor J.H. De Ridder is acknowledged and highly appreciated.

To Lesley Wyldbore, thank you for the language editing.

To my family, my wife Ntsiuoa Salome who played the father figure role when I was away for contact session with my supervisor, “Mokubong”! I really like to thank you very much for that bravery my love.

To my daughters Makgauta and Seipati who always wished me good luck when I left home, thank you very much and I will always love you.

To my brothers Montjetsi, Masende, Marata and my late brother Patrick, my two sisters Mapula and Maggie thank you all for your support.
Declaration

Prof. M.A. Monyeki (supervisor) and Prof. J.H. De Ridder (co-supervisor), the co-authors of the article which forms part of this dissertation, hereby give permission to the candidate, Mr P.M. Sathekge to include the article as part of a Masters’ dissertation. The contribution of each co-author, both supervisory and supportive, was kept within reasonable limits and included:

Mr P.M. Sathekge: Developed the proposal, data collection, statistical analyses, interpretation of the results, writing of the manuscript;

Prof. M.A. Monyeki: Principle investigator of the PAHL study. Coordinated the study, planning of the master’s degree study, advised on statistical analyses and interpretation thereof, structure of the manuscript, reviewing of the manuscript;

Prof. J.H. de Ridder: Planning of the master’s degree study, interpretation of the results, reviewing of the manuscript; thereby enabling the candidate to submit this dissertation for examination purposes.

This dissertation, therefore, serves as fulfilment of the requirements for the M.A. degree in Biokinetics within Physical, Activity, Sport and Recreation (PhASRec) in the Faculty of Health Sciences at the North-West University, Potchefstroom Campus.

_________________________________________  _______________________________________
Prof. dr. M.A. Monyeki                        Prof. dr. J.H. de Ridder
Co-author and supervisors                    Co-author and co-supervisor
ABSTRACT

Television viewing is one of the most easily modifiable causes of obesity among children. The purpose of this study was to determine the relationship between body composition and TV viewing among adolescents attending high schools in the Tlokwe municipality area of the North West province of South Africa. A cross-sectional study design which is part of the Physical Activity and Health Longitudinal Study (PAHLS) was followed on 154 learners (58 boys and 96 girls) who were aged 14 years in the Tlokwe municipality area. All the learners underwent anthropometric measurements of height, weight, and two skinfolds (triceps and subscapular skinfolds). Percentage body fat (%BF) was calculated from the two skinfolds according to Slaughter’s et al. (1988) equation. Children were classified into three groups (viz. normal, overweight and obese) according to BMI cut-off point suggested by Cole et al. (2000). Pearson correlation coefficients were used to determine the relationship between television viewing and body composition. The results show respectively high prevalence of overweight and obesity in girls (10.4%; 6.3%) as compared to the prevalence of 5% overweight in boys. With regard to TV viewing, the results show that 54% of the total group watch TV more than two hours a day, while only 11% watched TV less than one hour a day. The results show that the group that watches TV for more than 3 hours had high BMI (21.27kg/m²) and body mass (51.54kg). The group that watches TV for 1-2 hours had low BMI (18.36kg/m²) and body mass (44.79kg). There was a statistical significant relationship between BMI and body mass (p=0.001). A significant positive relationship between body mass and TV viewing (r=0.56; p=0.05) in overweight group was found, whilst in the obese group strong significant positive relationship was observed between percentage body fat and TV viewing (r=0.94; p=0.01). It can be concluded that girls were more overweight and obese respectively as compared to the boys. Furthermore, both boys and girls had high percentages of TV viewing for more than two hours a day. In addition, the results indicated that adolescents who watched TV more than 3 hours are heavier and fatter. Therefore, it is recommended that parents and educational
heads should encourage periods of daily physical activity. In addition, it is also important that parents play a more positive role in limiting the amount of hours their children spent watching television.

**Keywords**: Sedentary lifestyle, television viewing, body composition, adolescents, habitual physical activity, anthropometry.
Televisie kyk (TV) is een van die mees maklikste wysigbare oorsake van obesiteit onder kinders. Die doel van die studie was om die verhouding tussen liggaamsamestelling en TV kyk onder adolessensie wat hoër skole in die Tlokwe munisipaliteit omgewing van die Noordwes Provincie van Suid Afrika bywoon vas te stel. ’n Dwarsdeursnit studie-ontwerp wat deel is van die Fisieke Aktiwiteit en Gesondheid Longitudinale Studie (PAHLS) is geder op 154 leerlinge (58 seuns en 96 meisies) van 14 jaar oud in die Potchefstroom omgewing. Daar is antropometriese metings van lengte, gewig en twee velvoue (trisepsvelvou en kuitvelvou) op al die leerlinge gedaan. Persentasie liggaamsvet (% LV) is bereken van die twee velvoue, volgens die vergelyking van Slaughter’ et al. (1988). Die kinders is geklassifiseer in drie groepe (normaal, oorgewig en obes) volgens die BMI af-sny-punt soos voorgestel deur Cole et al. (2000). Die Pearson korrelasie koëffisiënt is gebruik om, die verband tussen TV-kyk en liggaamsamestelling te bepaal. Die resultate toon onderskeidelik hoë prevalensie van oorgewig en obesiteit by meisies (10.4%, 6.3%) in vergelyking met die prevalensie van 5% oorgewig by seuns. Met betrekking tot TV-kyk, wys die resultate dat 54% van die totale groep TV-kyk vir meer as twee ure per dag, terwyl net 11% TV-kyk vir minder as ’n uur per dag. Die resultate wys vender dat die groep wat TV-kyk vir meer as drie ure per dag ’n hoër BMI (21.27kg/m$^2$) en liggaamsmassa (51.54kg) toon het. Die groep wat TV gekyk het in 1-2 ure per dag het ’n laer BMI (18.36kg/m$^2$) en liggaamsmassa (44.79kg) toon. Daar was ’n statistiese betekenisvolle verband tussen BMI en liggaamsmassa (p=0.05). ’n Betekenisvolle positiewe verband is tussen die persentasie liggaamsvet en TV-kyk (r=0.56; p=0.05) in die oorgewig groep is gevind, terwyl in die obese groep, sterk positiewe en betekenisvolle verhouding waargeneem is tussen die persentasie liggaamsvet en TV-kyk (r=0.94; p=0.01). Gevolglik blyk dit dat meisies meer oorgewig en obes was as die seuns. Verder toon beide seuns en meisies ’n hoër persentasie van TV-kyk vir meer as twee ure per dag. Resultate dui verder aan dat die adolessente wat vir meer as 3 ure per dag TV-kyk swaarder en vetter is. Derhalwe word voorgestel dat die ouers en opvoedkundige hoofde daagliks periodes van fisieke aktiwiteit aanmoedig. Dit is ook verder belangrik dat ouers ’n meer positiewe rol speel in die vermindering van die ure wat hul kinders spandeer om TV te kyk.

**Sleutelwoorde:** Onaktiewe leefstyl, televisie kyk, liggaamsamestelling, adolessente, fisieke aktiwiteit, antropometrie
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**List of abbreviations**

**ACSM** = American College of Sports Medicine  
**BMI** = Body mass index  
**DLW** = Doubly-labelled Water  
**HEPA** = Health-enhancing Physical Activity  
**IPAQ** = International Physical Activity Questionnaire  
**MET** = Metabolic Equivalent  
**MVPA** = Moderate to Vigorous Physical Activity  
**PAHLS** = Physical Activity and Health Longitudinal Study  
**%BF** = Percentage Body Fat  
**TEE** = Total Energy Expenditure  
**TV** = Television  
**WHO** = World Health Organisation
Conference presentations and publications

**Topic:** Body composition and television viewing among high school adolescents in the Tlokwe Local Municipality, South Africa: The PAHL Study.

PM Sathekge, MA Monyeki and JH De Ridder

The research findings of this dissertation were presented at the international conferences as follows:

1. 9th Biennial conference of the Africa Association for Health, Physical Education, Recreation, Sport and Dance (AFAHPER-SD), Kyambogo University, Kampala, Uganda, 13th to 15th September 2011.

2. Be Active 2012 incorporating: 4th International Congress on Physical Activity and Public Health, Sydney Convention and Exhibition Centre, Oct 31 - 3 Nov 2012,

The abstract has been published in the *Journal of Science and Medicine in Sport (JSMS)*, Vol.15, Issue 6. (December), 2012, p.91.
Chapter 1: Introduction and aim of the study

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1.1 INTRODUCTION

Obesity is a major and rapidly growing global public health problem among children and adolescents (Ogden et al., 2002:1729; Gorden-Larsen et al., 2004:570; York et al., 2004:e466; WHO, 2007; Boone et al., 2007:26). A study conducted in the US in 2003-2004, revealed that 26.2% of children aged 2-5 years, 37.2% of children aged 6-11 years, and 34.4% of adolescents between 12-19 years were at risk of being overweight or obese (Ogden et al., 2002:1729). In South Africa, the prevalence of overweight and obesity in children is reported to be 14.0% and 3.2% in boys respectively and 17.9% and 4.9% in girls respectively (Armstrong et al., 2006:441). From an epidemiologic study (Andersen et al., 1998:938) and meta-analyses study (Marshall et al., 2004:1238) positive associations between obesity and television viewing were reported. In addition, it was also indicated that people in industrialized countries are expending less energy in activities of daily living and at work (Prentice & Jebb, 1995:438; US Department of Health and Human Services, 1996). Furthermore, Lazzer et al. (2005:37) revealed that physical activity is declining drastically during the adolescent stage, and this raises a serious concern for public health which warrants investigation.

Obesity is a strong predictor of morbidity, with central obesity associated with insulin resistance, dislipedemia and hypertension, all independent risk factors for cardiovascular disease and features of the metabolic syndrome (Steele et al., 2009:1185). According to Lazzer et al. (2005:37), approximately half of all obese children and adolescents are likely to become obese adults, who are more prone to suffer from chronic diseases than their thinner counterparts. Children who are less exposed to TV viewing and participate in regular physical activity, have significantly lower levels of adiposity (Robinson, 1999:1561). It was suggested that an active lifestyle during childhood and adolescence can play an important role in optimizing growth and development (US Department of Health and Human Services, 1996). The American Center for Disease Control and Prevention recommended that comprehensive school and community programmes should be developed to promote physical activity among children and adolescents (Center for Disease Control and Prevention, 1997). The goals of these programmes are to increase knowledge about
physical activity and exercise, to develop behavioural and motor skills that promote lifelong activity, and encourage physical activity outside of physical education classes (Andersen et al., 1998:938).

1.2 PROBLEM STATEMENT

One of the possible explanations for the decline in physical activity among children and adolescents is the increased hours of television viewing. Television viewing is one of the most easily modifiable causes of obesity among children (Eisienman et al., 2002:380; Fulton et al., 2009:30). Children spend more time watching television and videotapes, and playing video games than doing anything else except for sleeping (Bryant et al., 2007:199). Two mechanisms by which television viewing contributes to obesity have been suggested as reduced energy expenditure from displacement of physical activity, and increased dietary energy intake, either during TV viewing or as a result of food advertising (Bryant et al., 2007:199; Fulton et al., 2009:30). TV viewing time is also influenced by different factors such as the weather, school-systems, family structures, and social status (Grund et al., 2001:1245). Studies have found that having a TV in the bedroom, few family rules about TV viewing, and family meals in front of the TV are associated with more TV viewing among the youth (Swinburn & Shelly, 2008:S133) and as such are all found to be associated with the rapid rise in obesity (Proctor et al., 2003:829). Strong scientific evidence exists showing that physical inactivity is associated with substantially reduced physical, mental and social health among children and adults (Lazzer et al., 2005:38).

From the reviewed literature it is clear that low levels of moderate to vigorous physical activity (MVPA) and high levels of sedentary behaviour (e.g. television viewing) have been shown to be associated with obesity, although epidemiologic evidence in this area is not entirely consistent (Nelson et al., 2005:154; Mota et al., 2006:114; Mendoza et al., 2007:5). In a research study on Americans which investigated physical activity, body weight and TV viewing among children by Andersen et al. (1998:938), it was suggested that more studies focusing on other populations or countries should be conducted. Furthermore, the reviewed literature
revealed that physical activity plays an important role in enhancing active healthy lifestyle. It is against this background information that the following research questions are posed:

a) What are the body composition and TV viewing profiles among high school adolescent boys and girls in the Tlokwe municipality?
b) What is the relationship between body composition and TV viewing among high school adolescent boys and girls in Tlokwe municipality?

Answers to these research questions will provide more insight with regard to the relationship between TV viewing and body composition among adolescents in the Tlokwe municipality. In addition, it will help the Biokineticists, Human Movement Scientists and Recreationists to develop physical activity programmes to assist in combating obesity. And finally it is hoped that the results of this study will provide information to policymakers in the education department, as well as educators and parents about the importance of physical activity in adolescents.

1.3 OBJECTIVES

The objectives of this study were to determine:

- The body composition and TV viewing profiles among high school adolescent boys and girls in the Tlokwe municipality.
- The relationship between body composition and TV viewing among high school adolescent boys and girls in the Tlokwe municipality.

1.4 HYPOTHESES

The study was based on the following hypotheses:

- High prevalence of overweight and obesity and TV viewing hours among high school adolescent boys and girls in the Tlokwe municipality will be found.
- Significant positive relationship between overweight and obesity and TV viewing among high school adolescent boys and girls in the Tlokwe municipality will be found.
1.5 STRUCTURE OF THE DISSERTATION

The dissertation is presented in four main chapters, namely an introductory chapter (Chapter 1), a literature review (Chapter 2), and a research article (Chapter 3), followed by a summary with conclusions, limitations and recommendations (Chapter 4).

Chapter 1: Introduction comprised of problem statement, objectives, hypotheses and proposed chapters of the dissertation.

Chapter 2: Literature review: Body composition and television viewing in adolescents. (Reference Lists for both Chapters 1 and 2 will be provided at the end of each chapter according to the Harvard Style of referencing as stipulated by the guidelines in the postgraduate manual of the North-West University).

Chapter 3: Article 1. Body composition and television viewing among high school adolescents: the PAHL study. (The article will be submitted for publication in the *African Journal for Physical, Health Education, Recreation and Dance (AJPHERD)*).

Chapter 4: Summary, conclusions, limitations and recommendations.
1.6 REFERENCES


# Chapter 2: Body composition and television viewing in adolescents: Literature review

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2.1 INTRODUCTION

Overweight and obesity are reported to be associated with too much television viewing among children in many countries (Andersen et al., 1998:938; Gomez et al., 2007:41; Lioret et al., 2007:509). Furthermore, research studies which investigated the combined effects of television and physical activity on overweight and obesity, revealed low levels of physical activity and high levels of television watching among youth (Iannotti et al., 2009:191) and older children (Jago et al., 2005:557; Boone et al., 2007:27; Chen et al., 2007:358) to be associated with increased levels of overweight and obesity. In contrast, regular participation in physical activity has been found to be associated with health benefits such as improved bone mineral density and low blood pressure (Council on Sport Medicine and Fitness and Council on School Health, 2006:1834; Janssen & LeBlanc, 2010:7; Strong et al., 2005:732).

A study in the United States has revealed that watching TV for 4 or more hours per day is related to the increase in obesity and health-related problems among adolescents (Anderson et al., 1998:938). In addition, in this US study it was found that boys and girls who watched TV for more than 4 hours per day have shown to have a high percentage body fat and a greater Body Mass Index (BMI) than those who watched TV for less than 2 hours per day. It has been indicated that in Westernized countries, lifestyles of excessive energy intake and sedentary behaviour are associated with Type 2 diabetes mellitus and obesity in youth (Must et al., 1992:1350; Dietz & Robinson, 1998:191). The purpose of this chapter is to present literature on body composition and television viewing of adolescents, as well as the techniques for measuring body composition. In addition, to also present literature reviews on physical activity, techniques for measuring physical activity, research studies on body composition and TV viewing, and recommendations of physical activities for adolescents.
2.2 BODY COMPOSITION AND MEASURING TECHNIQUES

Body composition measures
Body composition is reported to be one component of physical fitness (Caspersen et al., 1985:126). Body composition can therefore be assessed by advanced methods such as under-water weighing, Air-Displacement Phlethysmography (a device such as the BodPod®) and Dual X-ray Absorptiometry. Common field methods used include skin fold’s thickness measurement (Norton & Olds, 1996; Brambilla et al., 2006:23), bio-electrical impedance (Ellis et al., 1999:75) or basic measurements of weight and height for calculation of the BMI (Pietrobelli et al., 2004:1479; Hills & Kagawa, 2007:39; ACSM, 2010:58). Of these, BMI is the simplest, most convenient and frequently used method. BMI is a useful measure of the relative proportion of fat mass in groups (Norton & Old, 1996).

Percentage body fat estimates can be derived by measuring skin fold’s thickness at three or more standard anatomical sites on the right side. The measurements are usually taken from the right side. The researcher pinches the skin at the appropriate site to raise a double layer of skin and the underlying adipose tissue, but not the muscle. The calliper is then applied one centimetre below, and at right angles to the pinched tissue, and a reading is taken two seconds later (Stewart et al., 2011). The mean of two measurements should be taken (Stewart et al., 2011). If the two measurements differ greatly, a third should be done, and then the mean of the two closest values are taken. Either the total sum of the measurements or a conversion to percentage body fat can be used as outcome measures. In converting the sum of the measurements to percentage body fat (%BF), internationally accepted equations for use in children and adolescents from different ethnic groups can be used (Slaughter et al., 1988).

2.3 PHYSICAL ACTIVITY AND ASSESSMENT TECHNIQUES

Physical activity is defined as “any bodily movement produced by skeletal muscles that results in energy expenditure (Caspersen et al., 1985:126; Caspersen et al., 1998:341; Biddle et al., 1998). This broad term means that physical activity includes
almost everything a person does and that inactivity is time spent doing things that do not markedly increase energy expenditure. Physical exercise on the other hand is defined as a subset of physical activity that is “planned, structured, and repetitive bodily movement done to improve or maintain one or more components of physical fitness” (Caspersen et al., 1985:127; Caspersen et al., 1998:341; Biddle et al., 1998). Physical fitness is a set of attributes related to a person’s ability to perform physical activities that require aerobic fitness, endurance, strength, or flexibility and is determined by a combination of regular activity and genetically inherited ability (Caspersen et al., 1985:127). Sport is another sub-set of physical activity that involves structured competitive situations, although it is often used in a wider context to include both exercise and leisure-time activities. Physical activity, exercise and sport may be classified as behaviours; physical fitness is classified as an outcome and is related to the ability to achieve certain performance standards or traits (Caspersen et al., 1998:341; Biddle et al., 1998; Ferron et al., 1999:231; Livingstone et al., 2003:682). Health-enhancing physical activity (HEPA) is defined as “any form of physical activity that benefits health and functional capacity without undue harm or risk” (Foster, 2000; Gregory & Lowe, 2000; Oja & Borms, 2004). These health-related physical fitness components include cardiovascular endurance, muscular endurance, muscular strength, body composition and flexibility, which, to varying extent, reflect genetic inheritance and gender, as well as levels of physical activity (Livingstone et al., 2003:682).

In epidemiological research, it has been indicated that being inactive or insufficiently active is often defined as not reaching the current physical activity recommendations, i.e. not being active enough for health (Dishman et al., 2004). Physical activity results in increased energy expenditure. Energy expenditure is usually expressed as the oxygen required per time unit based upon measurements of oxygen consumption (1.min⁻¹ or ml.min⁻¹.kg⁻¹). From the oxygen consumption, energy expenditure (kcal.min⁻¹) can be calculated. The energy expenditure can be expressed as a multiple of resting metabolic rate. To account for differences in resting metabolic rates related to gender, age and body composition the Metabolic Equivalent (MET) classification has been developed. One MET corresponds to average resting oxygen uptake (i.e. resting metabolic rate) in the sitting position, which is roughly equivalent
to 1 kcal. per kilogram body weight per hour or 3.5 ml oxygen per kg body weight per minute (Welk, 2002:125; McArdle et al., 2006; Hagströmer, 2007:3).

Livingstone et al. (2003:682) suggested that the dose of physical activity or exercise required to affect a particular health benefit response varies along four basic dimensions, to wit, frequency, intensity, duration & product of the frequency. Frequency is described as the number of activity sessions per time period (e.g. day or week). Intensity describes the measured or predicted energy cost associated with physical activity and may be described in relative or absolute terms. Duration may refer to a single bout of physical activity or a cumulative time measure, while type of activity is a qualitative descriptor. The product of the frequency, intensity and duration yields the total energy expenditure (TEE) associated with physical activity and is a measure of the volume of exercise performed (Livingstone et al., 2003:682).

Assessment of physical activity
It has been found that the accurate measurement of physical activity at population level is difficult due to the complex nature of physical activity itself (Murgatroyd et al., 1993:154; Melanson & Freedson, 1996:386; Motl et al., 2001:110; Mahar & Rowe, 2002; Morrow, 2002:37; Livingstone et al., 2003:682). Different techniques for assessing free-living physical activity can be grouped into two broad categories namely, subjective and objective:

a) Subjective physical activity measurements, includes observation and questionnaires (including activity diaries, recall questionnaires, interviews). Generally, questionnaires are most useful for assessing patterns, frequency, type and the context of physical activity. In particular, they are probably most effective for assessing easily-recalled, structured and time-delineated activities such as participation in sport, and routine activities such as walking to school. However, on the one hand, as pointed out by Wareham and Rennie (1998:S33), the undue emphasis in many questionnaires on sport and other recreational activities has been disproportionate to their true importance. On the other hand, activities of light-to-moderate intensity such as playing out of the home, occupational activities and a range of household tasks are no less important, but are difficult to define, and are
even more difficult to recall accurately (Sallis et al., 1985:93; Hopkins et al., 1991:75; Ainsworth et al., 2000a:S498). In addition, lower-intensity activities may display a great deal of intra-individual variation, and even if they are included in a survey, their usual patterns may not be characterized fully with just a single time-point assessment. The period of activity questionnaires can vary enormously, but in general the shorter the period the easier it is to recall, particularly for young children. However, this approach may be at the expense of capturing information about habitual activity patterns, particularly if there are marked seasonal differences in activity patterns (Livingstone et al., 2003:683).

**The International Physical Activity Questionnaire (IPAQ):** Different national and international studies on physical activity have used different methods of assessment, limiting the comparability of findings. The IPAQ instrument assesses health-enhancing physical activity. It measures time in walking and other moderate-to-vigorous intensity activities, in a seven day period, counting only those sessions which lasted 10 minutes or more (Craig et al., 2003:1381). The limit of 10 minutes was chosen because the recommendation for health-enhancing physical activity states that 30 minutes per day in at least moderate intensity is needed and that the 30 minutes can be split into 10 minute bouts (Pate et al., 1995:402; Haskell, 2007:303). All types of physical activity are included whether they are part of work, chores, transportation or leisure-time activity. The IPAQ also asks about time spent sitting, as an indicator of inactivity. This makes it possible to assess the amount of time spent at different intensity levels in a week, as well as the amount of total health-enhancing physical activity. The questionnaire is available in both a short (“IPAQ-short”, 7 items) and long form (“IPAQ-long”, 27 items), respectively. The short and long versions of the questionnaire have been piloted in 12 different countries in 14 sites to assess reliability and validity (Craig et al., 2003:1381; Lachat et al., 2008). The results suggested that the questionnaires had acceptable measurement properties for use in many settings and in different languages, and that the short version is suitable for national population-based prevalence studies (Ainsworth et al., 2000b:S498; Hallal & Victora, 2004:227; Ainsworth et al., 2006:1584; Ekelund et al., 2006:258; Fogelholm et al., 2006:753; Kolbe-Alexander et al., 2006:98; Mader et al., 2006:1255; Macfarlane et al., 2007:45).
Accuracy of self-reports: often used in epidemiological studies and have quite high feasibility. Physical activity as a behaviour can be assessed using indirect and direct measures. Direct methods include physical activity records and logs, direct observation, motion detectors and remote sensing systems. Indirect methods include 24-hour recalls, physical activity questionnaires and heart rate monitoring. The common method used is self-reporting by question (“self-reports”). These are easy to administer and cost-effective, but they are hampered by low accuracy (Ainsworth et al., 1999:219; Sallis & Saelens, 2000:S12; Ainsworth & Levy, 2004:239). The low accuracy is related to reactivity, recall biases, differential biases and social desirability.

Each of these methods has its strengths and limitations and can fulfil one or more, but rarely all the needs for epidemiological studies of physical activity. These measurements are only suitable for small and medium sized samples when information on the specific types and duration of activity in a variety of physical and social settings is the primary focus of concern. Because they are not biased by recall or self-reporting ability, these procedures of assessing physical activity are particularly suitable for young children (Bailey et al., 1995:1033). However, the methodology can be time-consuming, labour intensive and interfere with spontaneous activity patterns, and to be effective it requires extreme diligence and control of observer reliability (Livingstone et al., 2003:689).

For reasons of feasibility and cost, the instruments of choice in both small-scale and larger-scale studies of habitual physical activity in adolescents (Riddoch et al., 1990; Sallis et al., 1993:27; Gregory & Lowe, 2000) and adults (Jacobs et al., 1993:191; Philippaerts et al., 1999:284; Livingstone et al., 2001:1107) are standardized questionnaires (either administered by interview or self-reported), or diaries. However, diaries and recalls rely on memory and are subject to misrepresentation (particularly socially-desirable responding), and are inconsistent in reliability and validity (Westerterp, 1997:624). Accuracy in recalling physical activity may also vary by gender and weight status (Sallis et al., 1985:91). The utility of these instruments is especially problematic in children <10 years of age (Pate, 1993:321; Pate et al.,

b) **Objective physical activity measurements** which include physical indices such as motion sensors, calorimetry, and the doubly-labelled water (DLW) method.

**Motion sensors** include pedometers and accelerometers (Westerterp & Bouten, 1997:264; Tudor-Locke et al., 2002:2045; Hoos et al., 2004:1425; Tudor-Locke et al., 2004:796; Warms, 2006:80). They are developed in response to the lack of reliability of self-report measures, intrusiveness of direct observation and the complexity of heart rate monitoring (Puyau et al., 2002:152). These devices are, however, more appropriate for physical activity quantification in a typically sedentary population (Tudor-Locke & Myers, 2001:91).

**Accelerometers** offer considerable promise for providing valid assessments of intermittent activity of both low and high intensity (Welk, 2005:S501; Eston et al., 2006:753), however, they are relatively new and their definitive validity under field conditions remains to be established (Bouten et al., 1996:1019; Westerterp & Bouten, 1997:263; Johnson et al., 1998:1046; Ekelund et al., 2001:275; Foster et al., 2005:778). Accelerometer’s relative size remains an important practical consideration, particularly for smaller children (Westerterp, 1999:46). The accelerometers are able to determine physical activity intensity and pattern, i.e. the time spent on activities of low (sitting), moderate (walking) and high intensity (running) activities (Freedson et al., 1998:777; Hoos et al., 2004:1425). The high cost of accelerometers, has to date limited their use in large epidemiological studies (Livingstone et al., 2003:683). They are also affected by place of attachment on the body and discomfort to the participant (Westerterp, 1999:46; Tudor-Locke & Myers, 2001:92; Hoos et al., 2004:1426; Warms, 2006:81).

**Pedometers** are a means of measuring ubiquitous, ambulatory activities objectively as well as other structured physical activities (Schneider et al., 2003:1780). The main
areas where pedometers differ are cost, mechanism and sensitivity (Tudor-Locke et al., 2002:2046; Foster et al., 2005:778).

The advantage of pedometers are their accuracy compared to self-reported questionnaires; easy management of obtained data; reliability for determining physical activity in typically sedentary populations; and describing the total daily activities in free-living populations (Tudor-Locke & Myers, 2001:92; Tudor-Locke et al., 2002:796).

**Doubly-labelled water (DLW)** is the most socially acceptable and powerful technique for providing an objective measure of total energy expenditure (TEE) (Ekelund et al., 2001:276; Koebnick et al., 2005:303; Loprinzi & Cardinal, 2011:21). There are several advantages: the technique is non-intrusive and measurements are performed over longer periods than other techniques, typically ≥1-2 weeks, thus it is more likely to provide a representative estimate of TEE (Schoeller & Racette, 1990:1492; Murgatroyd et al., 1993:549). When combined with estimates of BMR, the energy cost of physical activity (TEE – BMR) can be calculated. This approach is of particular importance given that the accurate measurement of this component of TEE has traditionally been elusive under free-living conditions (Stager et al., 1995:166). However, because its application in large-scale studies is constrained by cost and technical complexity, one of its main uses is as a reference standard against which to assess the validity of other measures of physical activity. Furthermore, in epidemiological studies it may not even be the most appropriate method to apply since it provides no assessment of the patterns of physical activity (type, frequency, duration, intensity), which are important functional indicators of health status.

The Doubly-labelled water (DLW) method has some disadvantages too: it is expensive, has limited applicability, does not provide information about the type, pattern, frequency, intensity and duration of physical activity carried out during the day. DLW is not feasible for large population due to financial cost. Furthermore, DLW is sparse in the sense that special equipment is needed, highly trained personnel are required for carrying out the test as well as the necessity for collection of complete
urine samples which limits its usefulness for people with disabilities who has incontinence or use urinary collection equipment (Advirsson et al., 2005:377; Koebnick et al., 2005:303; Warms, 2006:80).

2.4 RESEARCH STUDIES ON BODY COMPOSITION AND TV VIEWING

Television viewing is one of the most easily modifiable causes of obesity among children (Eisenman et al., 2008:613; Fulton et al., 2009:30; Rivera et al., 2010:160). Children spend more time watching television and videotapes, and playing video games than doing anything else except for sleeping (Bryant et al., 2007:199). Two mechanisms by which television viewing contributes to obesity have been suggested as reduced energy expenditure from displacement of physical activity, and increased dietary energy intake, either during TV viewing or as a result of food advertising (Bryant et al., 2007:199; Fulton et al., 2009:30). TV viewing time is also influenced by different factors such as the weather, school-systems, family structures and social status (Grund et al., 2001:1245). Studies have found that having a TV in the bedroom, few family rules about TV viewing, and family meals in front of the TV are associated with more TV viewing among the youth (Swinburn & Shelly, 2008:S133), and as such are all found to be associated with the rapid rise of obesity (Proctor et al., 2003:829). Strong scientific evidence exists showing that physical inactivity is associated with substantially reduced physical, mental and social health among children and adults (Lazzer et al., 2005:38).

Some large epidemiological and meta-analysis studies have found positive associations between television viewing and childhood obesity (Andersen et al., 1998:938; Gortmaker et al., 1996:356; Marshall et al., 2004:1238). Previous intervention studies in school-age children have supported television and video viewing as causes of childhood obesity (Robinson et al., 1993:273; Gortmaker et al., 1996:356).

The Framingham Children’s Study (Proctor et al., 2003:832) revealed that children who watched the least television had parents with higher levels of education as well as parents who had lower levels of body fatness themselves. These findings are
consistent with other studies showing an inverse association between socioeconomic status and obesity (as well as the subsequent incidence of ischemic heart disease) (Marmot et al., 1991:1387). In addition, the Framingham Children’s Study (Proctor et al., 2003:832) indicated that children who watched the most television had the greatest increases in triceps and sum of skin folds and those who watched the least television had the smallest gains in body fat.

In countries such as the United States, the data has indicated a dramatically low level of physical activity, particularly among children and adolescents, so one would conclude that this is a major factor in causing a positive energy balance in the US population (Caballero, 2007:3).

A study from the National Health and Nutrition Examination Survey, 1999-2002 (Mendoza et al., 2007:1), indicated that preschool children in the US of who watched TV or videos for more than 2 hours/day of TV or videos had a higher risk of being overweight or were at higher risk for overweight and higher adiposity. These findings support national guidelines to limit preschool children’s media use. Computer use was also related to higher adiposity in preschool children, but not weight status.

In the project Eating Among Teens (EAT) (Barr-Anderson et al., 2009:1), it was revealed that television viewing in the middle and high school years predicted poorer dietary intake five years later. In addition, it was indicated that adolescents are primary targets of advertising for fast food restaurants, snack foods and sugar-sweetened beverages, which may influence their food choices. Furthermore it was indicated that TV viewing during high school may have long-term effects on eating choices and contribute to poor eating habits in young adulthood. In the longitudinal findings of Project EAT II of 1999 to 2004, it was found that mid-adolescence to late adolescence boys had increased hours of computer use from 10.4-15.2 hours per week, with an increase of 8.8 to 11.1 hours per week in girls.

A research study Greek Cypriot (Loucaides et al., 2011:2) reported that boys who attended sports clubs two or more times per week were more likely to be physically active. It was further indicated that girls who attended sports clubs two or more times
per week and who watched television for less than two hours were more likely to be physically active. In this study it was recommended that children must be encouraged to attend sports clubs at least twice per week so as to improve their physical activity levels.

A study conducted in Texas, on child activity and nutrition (Durant et al., 1994:449), presented contrasting results compared with other studies wherein it was found that television-watching was weakly and negatively correlated with physical activity levels, and physical activity was lower during television-watching than non-television-watching time in this sample of children. In addition this study did not show a significant association between TV viewing behaviour and body composition.

Another contrary study by Tammelin et al. (2009:1067) found a negative association between television watching and self-reported physical activity in a sample of 6,928, 15-16 year-old Finnish youths. In a sample of 40 boys aged 9-12, Hager (2006:656) observed that those who watched television after school were less likely to be active in comparison to those who did not watch television (as assessed by accelerometer).

In South Africa, a study on Youth Risk Behaviour survey (Reddy et al., 2002) reported that 37.5% of the youth aged from 13-19 do not participate in sufficient physical activity. In addition, 25% of the youth reported watching 3 hours of television per day. Indian boys are the most inactive (40.8%), followed by those of mixed ancestry (36.4%), Africans (34.4%), with the least inactive being Caucasian (28.2%). Mixed ancestry girls were the most inactive (56.8%), African (42.4%), Caucasians (37%) and lastly Indians (36%) (Lambert & Koble-Alexander, 2006:25). A study by Engelbrecht et al. (2004) in the North West province found that Indian girls (94.1%) were the most inactive group followed by those from mixed ancestry (87.5%), Africans (73.0%), and Caucasians (61.0%). African girls were involved in moderate physical activity (23.2%) and Caucasian girls in high physical activity (16.6%), while traditional games and house chores were the main source of activity among Africans. Walking slowly was found to be an activity enjoyed by all racial groups (Engelbrecht et al., 2004:42). In a study by Franz (2006:77), it was found that 32% of
the children did not meet the requirements of participating in physical activity for three and half hours per week in order to be classified as active.

2.5 RECOMMENDATIONS OF PHYSICAL ACTIVITIES FOR ADOLESCENTS

The American College of Sport Medicine (Table 2.1) (ACSM, 1978) and the American Heart Association (AHA) (Haskell et al., 2007:1081) emphasized that 30 minutes of moderate intensity physical activity should be regularly performed on at least five days per week (compared to “most, preferably all” days in the 1995 recommendation), but also that the 30 minutes of moderate intensity physical activity could be substituted by three occasions of 20 minutes of vigorous activity per week. On top of these activities, ten strength-training exercises, eight to twelve repetitions of each exercise twice a week, are recommended (Table 2.1). The recommendation also highlights that these activities are over and above daily living routines (such as self-care and cooking) or activities which last less than 10 minutes (such as walking around home or office, walking from parking lot). Furthermore, the new recommendation has separated healthy adults and older adults (>64 years) or adults (50-64 years) with chronic conditions (Table 2.1).

The recommendations on health-enhancing physical activity seem straightforward: people are supposed to be more and more active. It is recommended that the dose-response relationship between physical activity and different diseases suggests a need for them to be modified to suit individual circumstances (Suitor & Kraak, 2007). Further in the table, it is recommended that to prevent transition from normal weight to overweight or obesity, 45-60 minutes of moderate intensity daily activity is required, and to prevent weight regain in formerly obese individuals 60-90 minutes of moderate intensity activity is required daily (Saris et al., 2003:101).
### Table 2.1: Physical activity recommendations by the different organisations

<table>
<thead>
<tr>
<th>Organization</th>
<th>Year</th>
<th>Recommendation</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>National board of health and welfare (Sweden)</td>
<td>1971</td>
<td>Be active on moderate intensity every day in combination with more intense exercise 2-3 times per week</td>
<td>Health and fitness</td>
</tr>
<tr>
<td>ACSM</td>
<td>1978</td>
<td>3-5 times per week, 15-60 min per occasion, 60-90% HRmax on aerobic exercise</td>
<td>Maintain and improve fitness</td>
</tr>
<tr>
<td></td>
<td>1990</td>
<td>In 1990, strength training was added</td>
<td></td>
</tr>
<tr>
<td>Health Education Authority, (England) Pate et al., and CDC, Surgeon General (US)</td>
<td>1994</td>
<td>30 minutes of daily moderate intensity physical activity</td>
<td>Health</td>
</tr>
<tr>
<td>Health</td>
<td>1995</td>
<td>30 minutes of at least moderate intensity on most, preferably all, days of the week (150 kcal per), accumulated in several bouts of at least 10-minutes duration (Pate, 1995)</td>
<td>Health</td>
</tr>
<tr>
<td>ACSM</td>
<td>1998</td>
<td>3-5 times per week, 15-60 min per occasion, 55-90% HRmax on aerobic exercise plus strength and flexibility training</td>
<td>Maintain or improve fitness</td>
</tr>
<tr>
<td>IASO</td>
<td>2003</td>
<td>For prevention; 45-60 minutes per day of at least moderate intensity</td>
<td>Prevent obesity or maintain weight loss</td>
</tr>
<tr>
<td>For maintenance: 60-90 min per day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACSM, AHA</td>
<td>2007</td>
<td>30 minutes of at least moderate intensity daily, or 20 minutes of vigorous intensity 3 times per week. On top of these, strength training twice a week.</td>
<td>Health and fitness</td>
</tr>
</tbody>
</table>

ACS; American College Sports Medicine (ACSM, 1978; 1998; 1990; 1998; Haskell et al., 2007)

CDC; Center for Disease Control and Prevention (CDC et al., 1996)

IASO; International Association for the Study of Obesity (Saris et al., 2003)

AHA; American Heart Association (Haskell et al., 2007)

In response to the growing problem of childhood obesity and other health issues associated with television, the American Academy of Paediatrics (AAP) has issued national guidelines for parents to limit their children’s total media time (with entertainment media) to no more than 1-2 hours of quality programming per day for children 2 years of age and older (Barlow & Dietz, 1998; Krebs et al., 2007:S195). It was also indicated that energy balance at such a low level of energy output could be maintained only by major reductions in food intake (Caballero, 2007:3).

### 2.6 CONCLUSION

This chapter has outlined the concepts that affirm that body composition and television viewing in adolescents are related and also showed the contrasting ideas...
from literature reviewed. Literature reviewed revealed that television viewing is one of the most easily modifiable causes of obesity among children. This has been suggested by two mechanisms that is reduced energy expenditure from displacement of physical activity, and increased dietary energy intake, either during TV viewing or as a result of food advertising. Literature has also revealed the association between having TV in the bedroom, few family rules about TV viewing, and family meals in front of the TV among youth. Scientific evidence showed that physical inactivity is associated with substantially reduced physical, mental and social health among children and adults. Positive associations between television viewing and childhood obesity were found in some large epidemiological and meta-analysis studies. Literature also revealed that children who watched the most television had the greatest increases in triceps and sum of skin folds and those who watched the least television had the smallest gains in body fat. In the United States the data showed a dramatically low level of physical activity, particularly among children and adolescents, so one would conclude that this is a major factor in causing a positive energy balance in the US population. In some studies it was indicated that watching TV more than 2 hours/day in US preschool-age children was associated with a higher risk of being overweight and higher adiposity-findings in support of national guidelines to limit preschool children’s media use. It was revealed that television viewing in the middle and high school predicted poorer dietary intake five years later, adolescents were targets of advertising for fast food restaurants, snack foods and sugar sweetened beverages which may influence their food choices. TV viewing may have long term effects on eating choices and contribute to poor eating habits in young adulthood. It was also reported that boys who attended sports clubs for two or more times per week were more likely to be physically active. Girls who attended sports clubs for two or more times per week and who watched television for two hours were more likely to be physically active. Literature also presented contrasting results, in some studies it was found that television watching was weakly negatively correlated with physical activity levels, and physical activity was lower during television-watching than non-television-watching time in the sample of children.
The next chapter will consist of an independent research article which will integrate the information from the reviewed literature in the problem statements hence in the interpretation/discussion of the results findings. The objective of the article was to determine the relationship between body composition and TV viewing among adolescents attending high schools within the Tlokwe Local Municipality: The PAHL study.
2.7 REFERENCES


Jago R., Baranowski T., Baranowski J.C., Thompson, D. & Greaves K.A. 2005. BMI from 3-6 year of age is predicted by TV viewing and physical activity, not diet. *International journal obesity*, 29:557-564.


Chapter 3: Body composition and television viewing among high school adolescents: the PAHL study

1P.M. Sathekge, 1M.A. Monyeki and 1J.H. De Ridder

1Physical Activity, Sport and Recreation Research Focus Area (PHASRec) in the School of Biokinetics, Recreation and Sport Science, North-West University, Potchefstroom Campus, Republic of South Africa, E-mail: andries.monyeki@nwu.co.za

The article is prepared for submission to the African Journal for Physical, Health Education, Recreation and Dance (AJPHERD). Subsequently the referencing style used in this chapter will be in line with the journal guidelines.
Body composition and television viewing among high school adolescents: the PAHL study

P.M. Sathekge, M.A. Monyeki and J.H. De Ridder

Physical Activity, Sport and Recreation Research Focus Area in the School of Biokinetics, Recreation and Sport Science, North-West University, Potchefstroom, Republic of South Africa.

Corresponding author's email: andries.monyeki@nwu.ac.za

Abstract

The purpose of this study was to determine the relationship between body composition and TV viewing among adolescents attending high schools in the Tlokwe municipality area of the North West province of South Africa. A cross-sectional study design which is part of the Physical Activity and Health Longitudinal Study (PAHLS) was followed on 154 learners (58 boys and 96 girls) aged 14 years in the Tlokwe municipality area. All the learners underwent anthropometric measurements of height, weight, and two skin folds (triceps and subscapular skinfolds). Percentage body fat (%BF) was calculated from the two skin folds according to Slaughter’s et al. (1988) equation. Children were classified into three groups (viz. normal, overweight and obese) according to the BMI cut-off points suggested by Cole et al. (2000). Pearson’s correlation coefficient was used to determine the relationship between television viewing and body composition. The results showed respectively high prevalence of overweight and obesity in girls (10.4%; 6.3% respectively) as compared to the prevalence of 5% in boys. With regard to TV viewing, the results show that 54% of the total group watch TV more than two hours a day, while only 11% watched TV less than one hour a day. The results show that the group that watches TV for more than 3 hours had high BMI (21.27kg/m²) and body mass (51.54kg) respectively. The group that watches TV for
1-2 hours had lower BMI (18.36 kg/m²) and body mass (44.79 kg). There was a significant statistical relationship between BMI and body mass (p=0.001). A significant positive relationship between body mass and TV viewing (r=0.56; p=0.05) in the overweight group was found, whilst in the obese group a strong significant positive relationship was observed between percentage body fat and TV viewing (r=0.94; p=0.01). It can be concluded that girls were more overweight and obese respectively as compared to the boys. Furthermore, both boys and girls had high percentages of TV viewing for more than two hours a day. In addition, the results indicated that adolescents who watched TV more than 3 hours are heavier and fatter. Therefore, it is recommended that parents and educational heads should encourage periods of daily physical activity. In addition, it is also important that parents play a more positive role in limiting the amount of hours their children spend watching television.

**Keywords:** Sedentary lifestyle, television viewing, body composition, adolescents, habitual physical activity, anthropometry.
Introduction

Obesity has become a major public health problem among children and adolescents. In the US, a study conducted in 2003-2004 revealed that 26.2% of children aged 2-5 years, 37.2% of children aged 6-11 years, and 34.4% of adolescents of 12-19 years of age were at risk of overweight or obese (Ogden, Carrol, Curtin, McDowell, Tabak & Flegal, 2006; Mendoza, Zimmerman & Christakis, 2007; Ogden, Carroll, Kit & Flegal, 2012). In both epidemiologic and meta-analyses studies, positive associations between television viewing and obesity were reported (Andersen, Crespo, Bartlett, Cheskin, & Prattbl. 1998; Marshall, Biddle, Gorely, Cameron & Murdey, 2004; Gortmaker, Peterson, Wiecha, Sobol, Dixit & Fox, 1999). Furthermore, it was revealed that during puberty (the stage before adolescence), physical activity is drastically in decline, and as such this raises a serious concern for public health which warrants investigation (Lazzer, Boirie, Poissonnier, Petit, Duché, Taillardat, Meyer & Vermorel, 2005).

Television viewing is one of the most easily modifiable causes of obesity among children (Fulton, Wang, Yore, Carlson, Galuska & Caspersen, 2009). Children spend more time watching television and videotapes and playing video games, than doing anything else except sleeping. Two mechanisms by which television viewing contributes to obesity have been suggested: reduced energy expenditure from displacement of physical activity and increased dietary energy intake, either during viewing or as a result of food advertising (Mendoza et al., 2007). Children with reduced exposure to television would significantly decrease their level of adiposity (Robinson, 1999). Reduced physical activity results in reduced total energy expenditure (TEE), favouring positive energy storage. An association between TV viewing and overweight has frequently been observed. These associations were explained by:

1) TV viewing causing overweight and obesity by reduced resting energy expenditure;
2) replacement of physical activities;
3) a higher consumption of unhealthy food items (like sweets, cakes and fast foods); and/or obesity itself increases TV viewing.
Children with high TV-viewing time had a higher fat mass, which is attributed to frequent snacking or consumption of high fat diets during TV viewing. These data suggest that the poor nutritional habits associated with TV viewing may add to overweight in subjects watching a lot of TV. TV viewing time is influenced by different factors, for example the weather, school-systems, family structures and social status (Grund, Krause, Siewers, Rieckert & Müller, 2001).

Studies have found that having a TV in the bedroom, few family rules about TV viewing, and family meals in front of the TV are associated with more TV viewing among youth (Swinburn & Shelly, 2008). The metabolic rate is reduced during TV viewing in obese and normal weight youths. TV watching also reduces energy expenditure and is thus an important risk factor for childhood obesity. Adolescent obesity is a strong risk for diabetes, hypertension, and ischemic heart disease. Recent studies showing a dramatic rise in the rates of obesity in both children and adults in the US are cause for alarm. An increasing number of hours spent watching TV is one mechanism that may underlie these rapidly rising rates (Proctor, Moore, Gao, Cupples, Bradlee, Hood & Ellison, 2003). Strong scientific evidence exists that physical inactivity is associated with substantially reduced physical, mental, and social health among adults and excess body fat is associated with increased risk for several chronic diseases among adults, and undesirable and orthopaedic and psycho-social outcomes among children and youth (Lazzer et al., 2005).

People in industrialized countries are expending less energy both in activities of daily living and at work (Andersen et al., 1998). According to Lazzer et al. (2005) approximately half of all obese children and adolescents are likely to become obese adults who are more prone to suffer from chronic diseases than their non-obese counterparts. Obesity is a strong predictor of morbidity, with central obesity associated with insulin resistance, dislipidemia and hypertension; all independent risk factors for cardiovascular disease and features of the metabolic syndrome (Steele, Van Sluijs, Cassidy, Griffon & Ekelund, 2009).

Low levels of moderate to vigorous physical activity (MVPA) and high levels of sedentary behaviour (e.g. television viewing) have been shown to be associated with
obesity, although epidemiologic evidence in this area is not entirely consistent (Nelson, Stzainer, Hannan, Sirard & Story, 2006). It is against this background information that the present study aimed to determine the relationship between body composition and TV viewing among adolescents attending high schools in the Tlokwe local municipality of the North West province of South Africa.

Methodology

Research design and ethical aspects
For the purpose of the present study, a baseline data for 2010 was used. The present research is part of a larger study, in essence, the Physical Activity and Health Longitudinal Study (PAHLS) which is an observational multidisciplinary longitudinal design planned for five years. Prior to the study, permission to conduct the measurements was granted by the District Manager of the Department of Education in Potchefstroom. In addition, the Ethics Committee (Ethics no: NWU– 0058-01–A1) of the Potchefstroom Campus of the North-West University granted approval for the study.

Participants
The participants of this study comprised a total of 154 learners (58 boys and 96 girls) aged 14 years, from high schools in the Tlokwe Local Municipality of the North West Province of South Africa, and who completed measurements of physical activity during the baseline data collection in 2010. The study is described in detail elsewhere (Monyeki, Neetens, Moss & Twisk, 2012).

Measuring instruments for body composition

Anthropometric measurements of height, weight, skinfold thickness (triceps and sub scapular skinfolds) were measured through the standard procedure described by the International Standard of Advancement of Kinanthropometry (ISAK) (Stewart, Marfell-Jones, Olds & De Ridder, 2011). Height was measured by a stadiometer to the nearest 0.5cm, with the subject standing upright with their head in the Frankfort
plane. Weight was measured by using a portable electronic scale to the nearest 0.1kg. BMI was calculated as weight divided by height squared, and the subjects classified according to the age- and sex-adjusted BMI cut-offs for overweight and obesity – as outlined by Cole, Bellizzi, Flegal and Dietz (2000), and Cole, Flegal, Nicholls and Jackson (2007). The triceps’ and subscapular skinfolds were measured to the nearest 0.5mm using a Harpenden Caliper. Percentage body fat was derived from skin fold measurement according to the equation developed by Slaughter, Lohman, Boileau, Horswill, Stillman, Van Loan, and Bemben (1988).

**Measuring of physical activity**

Physical activity (PA) was assessed by the use of a short form of the International Physical Activity Questionnaire (IPAQ) (CDC, 2002; WHO 2002; WHO, 2009), which is internationally approved for use by adolescents in different settings (WHO, 2002). The IPAQ-short consists of seven (7) items that identify frequency and time spent in walking and other moderate-to-vigorous intensity physical activities, during the seven days prior to the questionnaire’s administration, and counts only those sessions that lasted 10 minutes or more. All types of physical activities are included whether they are part of occupation, transportation, household chores or leisure time activity. It also asks about time spent sitting, as an indicator of inactivity. The IPAQ has been tested for reliability and validity in the so-called 12-country validation study (Craig et al., 2003:1388). For the purpose of this study, information from the IPAQ questionnaire based on time spent watching TV was analysed. To determine the time spent watching TV, hours spent watching TV were classified as follows: don’t know=0; less than 1 hour=1, 2-3 hours=2 and more than 3 hours=3. The participants were stratified according to their daily TV consumption (mean TV viewing time) in accordance with the Third National Health and Nutrition Examination Survey guidelines (Andersen et al., 1998:939; Bryant, Lucove, Evenson & Marshall, 2007).
Test procedures

The purpose and procedures of the study were explained to both the parents and the children wherein a signed informed consent form was granted. Measurements were conducted following these phases:
Phase I: Physical activity questionnaire was assessed separately from the other test measurements under the supervision of the principal investigator.
Phase II: Anthropometric measurements of height, weight, triceps and subscapular skinfolds were measured in separate rooms for boys and girls by certified anthropometrists.

Statistical Analysis

The SPSS Version 17.0 (SPSS Inc., Chicago, II 2009) statistical programme was used to process and analyse the data. Non-parametric technique was used to calculated the descriptive statistic (i.e. means, standard deviations, frequencies) for TV viewing and body composition. In addition, correlation coefficients were calculated to determine the relationship between TV viewing and body composition. Significance level was set at p≤ 0.05.

Results

Figure 1 (a and b) presents the distribution of children according to their BMI classification by gender. A total of 55 boys which accounts for 94.8% of the population were normal, 3 boys (5.2%) were overweight, and no obese boys were identified in the total population. A total number of 80 girls accounting for 83.3% of the sample were normal, 10 girls (10.4%) were overweight, and 6 girls (6.3%) were obese.
Figure 1: Prevalence of overweight and obesity for boys and girls

![Graph showing prevalence of overweight and obesity for boys and girls.]

(a) Boys

- Normal: 94.80%
- Overweight: 5.20%

(b) Girls

- Normal: 83.80%
- Overweight: 10.40%
- Obese: 6.20%

Figure 2: Prevalence of TV viewing for the total group

![Graph showing TV viewing for the total group.]

Figure 2 presents the percentage score for TV viewing for the total group. The results show that 54% of the total group watch TV for more than one hour a day, while only 11% watched TV less than one hour a day.
Table 2: Percentages of TV viewing of boys and girls

<table>
<thead>
<tr>
<th>Hours on TV</th>
<th>Boys (n=58)</th>
<th>Girls (n=96)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Don't know</td>
<td>13 (22)</td>
<td>41 (43)</td>
</tr>
<tr>
<td>Less than 1 hour of TV</td>
<td>12 (21)</td>
<td>5 (5)</td>
</tr>
<tr>
<td>2-3 hours of TV</td>
<td>18 (31)</td>
<td>19 (20)</td>
</tr>
<tr>
<td>More than 3 hours of TV</td>
<td>15 (26)</td>
<td>31 (32)</td>
</tr>
<tr>
<td>Total</td>
<td>58 (100)</td>
<td>96 (100)</td>
</tr>
</tbody>
</table>

In Table 2, the results show a high percentage of TV viewing by both boys (57%) and girls (52%) respectively. The results show that only five girls and 12 boys indicated that they watched TV for less than an hour a day.

Table 3: Means and standard deviations of anthropometric measurements according to TV viewing

<table>
<thead>
<tr>
<th>Hours on TV</th>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stature</td>
<td>154.29</td>
<td>6.51</td>
</tr>
<tr>
<td>Don't Know</td>
<td>Body mass</td>
<td>49.3</td>
<td>9.64</td>
</tr>
<tr>
<td></td>
<td>BMI</td>
<td>20.63</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>Percentage Body fat</td>
<td>13.2</td>
<td>6.54</td>
</tr>
<tr>
<td>1-2 hours</td>
<td>Stature</td>
<td>155.98</td>
<td>8.59</td>
</tr>
<tr>
<td></td>
<td>Body mass</td>
<td>44.79</td>
<td>7.65</td>
</tr>
<tr>
<td></td>
<td>BMI</td>
<td>18.36</td>
<td>2.97</td>
</tr>
<tr>
<td></td>
<td>Percentage Body fat</td>
<td>11.95</td>
<td>6.96</td>
</tr>
<tr>
<td>2-3 hours</td>
<td>Stature</td>
<td>151.71</td>
<td>7.33</td>
</tr>
<tr>
<td></td>
<td>Body mass</td>
<td>45.11</td>
<td>11.05</td>
</tr>
<tr>
<td></td>
<td>BMI</td>
<td>19.44</td>
<td>3.76</td>
</tr>
<tr>
<td></td>
<td>Percentage Body fat</td>
<td>12.58</td>
<td>5.63</td>
</tr>
<tr>
<td>More than 3 hours</td>
<td>Stature</td>
<td>155.39</td>
<td>6.41</td>
</tr>
<tr>
<td></td>
<td>Body mass</td>
<td>51.54</td>
<td>13.63</td>
</tr>
<tr>
<td></td>
<td>BMI</td>
<td>21.27</td>
<td>5.16</td>
</tr>
<tr>
<td></td>
<td>Percentage Body fat</td>
<td>12.94</td>
<td>6.39</td>
</tr>
</tbody>
</table>
Table 3 presents the descriptive characteristics (mean and standard deviation) of adolescents, classified into 4 groups of hours spent watching TV namely, don't know, 1-2 hours, 2-3 hours, and more than 3 hours. The group that watched TV more than 3 hours was relatively heavier and fatter than the group that do not know how many hours they spent watching TV, and the group that watched TV less than 3 hours.

Table 4: Correlation matrix for body composition and TV viewing of normal, overweight and obese adolescents

<table>
<thead>
<tr>
<th>Variables</th>
<th>Normal group</th>
<th>Overweight group</th>
<th>Obese group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BMI</td>
<td>Body mass</td>
<td>%BF</td>
</tr>
<tr>
<td>BMI</td>
<td>-</td>
<td>-</td>
<td>.86</td>
</tr>
<tr>
<td>Body mass</td>
<td>.86</td>
<td>.001</td>
<td>-</td>
</tr>
<tr>
<td>%BF</td>
<td>.01</td>
<td>.90</td>
<td>.01</td>
</tr>
</tbody>
</table>

$r$ = correlation coefficient; ** $p < 0.05$; BMI = Body mass index; %BF = Percentage body fat

Table 4 presents the correlation matrix for body composition and TV viewing for normal, overweight and obese groups in adolescents. The results show a significant positive relationship between BMI and body mass. No significant relationship was found for body composition parameters and TV viewing in the normal group. A significant relationship was found for body mass and TV viewing in the overweight group. In the obese group a significant relationship was observed for body fat and TV viewing.

Discussion

The results showed high prevalence of overweight especially in girls, and also relatively high percentages of hours spent viewing TV among boys and girls respectively. Girls were more overweight than the boys, whilst TV viewing was high in both boys and girls. Furthermore, the results show significant relationships between body mass, body fat and TV viewing respectively in the overweight and
obese group adolescents entering high schools in the Tlokwe local municipality of the North West province. Furthermore, the results show that adolescents who watched TV more than 3 hours were heavier and fatter than the other groups.

The relatively high prevalence of overweight and obesity in the present study is in line with the findings on American children and adolescents with 31.8% being overweight and 16.9% obesity (Ogden et al., 2012). It was stated that the prevalence of obesity is high in children who watched TV for more than 4 hours a day (Crespo, Smit, Troiano, Bartlett, Macera & Andersen, 2001). A similar trend was also food in the present study in which adolescents who watched TV for more than 3 hours had higher BMI and percentage body fat than those who watched TV for less hours a day. In the present study, percentage body fat was significantly associated with hours spent in TV viewing, as such these findings are congruent with a study by Andersen et al. (1998) in which it was revealed that skin fold thickness increased as the amount of TV viewing increased. In addition, it was also reported that children that spend more time watching TV are less likely to participate in vigorous activity and thus gain an increase in their BMI (Ross & Gilbert, 1985). Significant associations between overweight and obesity and TV viewing in school going girls, as well as with sedentary behaviour (combined TV and computer use) was found (Eisenmann, Bartee & Wang, 2002). Media use may encourage unhealthy food intake and also reduce opportunities for physical activity (Fulton et al., 2009).

It should be noted that this study has some limitations. The nature of the present study was a cross-sectional study; this however proved to be a major limitation as it was based on a specific age category, and previous studies found that BMI and body composition increased significantly as age also increased. Furthermore, the lack of overall total physical activity as well as dietary patterns which were not available for the present study are the limitations to the findings. It is therefore recommended that further studies should include a larger number of subjects, total physical activity as well as dietary practices following a longitudinal design and also cover a wider spectrum of the South African population, not only the Tlokwe local municipality of the North West province.
Conclusion

It can be concluded that the prevalence of overweight exists (especially in girls), and also relatively high hours spent viewing TV was evident in the studied sample. In addition, significant relationships were observed between body composition and TV viewing in overweight and obese adolescents in the Tlokwe local municipality of the North West province. And further, a prevalence of high body composition in adolescents watching TV for more than 3 hours was found. Based on the results of the present study, it is therefore recommended that both parents and educational heads encourage periods of daily physical activity, and parents play a more positive role in limiting the amount of hours their children spend watching television.

Acknowledgments

We thank the participants of this study; the schools and parents for their participation in the PAHL study; team members in the PAHL study for the data collection as well as the financial support from Physical Activity, Sport and Recreation (PHASRec) Niche Area.

The financial support from the National Research Foundation of South Africa (NRF) and Medical Research Council (MRC) is highly appreciated.

Disclaimer: Any opinion, findings, conclusions or recommendations expressed in this material are those of the authors and, therefore, the NRF does not accept any liability in this regard.
References


CHAPTER 4: SUMMARY, CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

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</tbody>
</table>
4.1 SUMMARY

In Chapter 1 the introduction and outline of the problem statement are presented. The first objective of the study was to determine the body composition and TV viewing profiles among high school adolescent boys and girls in the Tlokwe municipality. The second objective was to determine the relationship between body composition and TV viewing among high school adolescent boys and girls in the Tlokwe municipality. Chapter 1 describes the problem, objectives and hypothesis of the study.

Chapter 2 consists of a literature review on the body composition, techniques for measuring body composition, physical activity, techniques for measuring physical activity, research studies on body composition and TV viewing, and recommendations of physical activities for adolescents. From the reviewed literature it was revealed that television viewing is one of the most easily modifiable causes of obesity among children (Eisienman et al., 2002:380; Fulton et al., 2009:30). Literature also revealed the association between having a TV in the bedroom, few family rules about TV viewing, and family meals in front of the TV among youth (Swinburn & Shelly, 2008:S133), and the rapid rising in obesity (Proctor et al., 2003:829). Literature also provided scientific evidence which showed that physical inactivity is associated with substantially reduced physical, mental and social health among children and adults (Lazzer et al., 2005:38). Some studies showed positive associations between television viewing and childhood obesity; children who watched the most television had the greatest increase in triceps’ size and sum of skin folds, while those who watched the least television had the smallest gains in body fat (Proctor et al., 2003:832). Some contrasting results were also presented by literature, to wit, that television watching was weakly negatively correlated with physical activity levels, and physical activity during television-watching was lower than non-television time in the sample of children (DuRant et al., 1994).

Literature revealed various methods which can be used to measure body composition and they are as follows:
Underwater weighing, Air-Displacement, plethysmography, skin fold thickness measurement (Norton & Olds, 1996), bioelectrical impedance (Ellis, 2001) or basic measurement of weight and height for calculation of the body mass index (BMI) (Pietrobelli et al., 1998; Hills & Kagawa, 2007:39; ACSM, 2010:58). The literature also indicated various subjective methods of assessing physical activity as observation and questionnaires, and objective measures being motion sensors, calorimetry, and doubly-labelled water (DLW). The chapter ends with the summary.

Chapter 3 was presented in the form of a research article. The literature review, method of research, research design, results, discussion, and conclusion are presented in the article. The title of the article is as follows:

“Body composition and television viewing among high school adolescents: the PAHL study”

4.2 CONCLUSIONS

The conclusions drawn from this research are in accordance with the hypotheses set in Chapter 1.

4.2.1 Hypothesis 1: A high prevalence of overweight and TV viewing hours among high school adolescent boys and girls in the Tlokwe municipality will be found.

The results show respectively a high prevalence of overweight and obesity in girls (10.4%; 6.3%) as compared to the prevalence of 5% in boys. With regard to TV, the results show that 54% of the total group watch TV for more than two hours a day, while only 11% watched TV less than one hour a day. The results show that the group that watches TV for more than 3 hours had high BMI (21.27kg/m²) and body mass (51.54kg). The group that watches TV for 1-2 hours had low BMI (18.36kg/m²) and body mass (44.79kg). Hypothesis 1 can therefore be accepted.
4.2.2 Hypothesis 2: Significant positive relationship between body composition and TV viewing among high school adolescent boys and girls in the Tlokwe municipality will be found.

There was a statistical significant relationship between BMI and body mass (p=0.001). No significant relationship was found for body composition parameters and TV viewing in the normal group. A significant positive relationship between body mass and TV viewing (r=0.56; p=0.05) in the overweight group was found, whilst in the obese group, a strong significant positive relationship was observed between percentage body fat and TV viewing (r=0.94; p=0.01). Hypothesis 2 is partially accepted.

4.3 LIMITATIONS

The present study has several limitations which should be noted when interpreting the results. The nature of the present study was a cross-sectional study; this however proved to be a major limitation as it was based on a specific age category, and previous studies have found that BMI and body composition increased significantly as age increases. Furthermore, the lack of overall total physical activity as well as dietary patterns which were not available for the present study are the limitations to the findings. It is therefore recommended that further studies should include a larger number of subjects, total physical activity as well as dietary practices following a longitudinal design and also cover a wider spectrum of the South African population, not only the Tlokwe local municipality of the North West province.

4.4 RECOMMENDATIONS

4.4.1 From the results of this study it would appear that there is a high prevalence of overweight or obesity among adolescents and as such the study recommends that parents and educational heads should encourage their children to periods of daily physical activity. Furthermore, intervention programs to prevent and manage overweight and obesity are recommended.
4.4.2 The results show high prevalence of TV viewing among adolescents. In addition the results show that the children who watched TV more than 3 hours were heavier and fatter than the other groups. It is therefore recommended that parents should play a more positive role in limiting the amount of hours their children spend watching television. Furthermore, adolescents must be provided with skills and knowledge about the negative effect of too much TV viewing.

4.4.3 The results show significant positive relationships between body mass and percentage body fat in both overweight and obese children. The study therefore recommends an urgent need to introduce preventative physical activity programmes geared towards overweight and obese children as well as the normal group so as to manage the development of the observed prevalence.

4.4.4 The cross-sectional nature of the study might have affected the results one way or the other, therefore more studies which follow a longitudinal design method are required.

4.4.5 The use of questionnaires in assessing TV viewing might have limited the present findings. More studies which follow objective methods in assessing TV viewing are needed.


# APPENDICES

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APPENDIX A

GUIDELINES FOR AUTHORS

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

i) Provide a forum for physical educators, health educators, specialists in human movement studies and dance, as well as other sport-related professionals in Africa, the opportunity to report their research findings based on African settings and experiences, and also to exchange ideas among themselves,

ii) Afford the professionals and other interested individuals in these disciplines the opportunity to learn more about the practice of the disciplines in different parts of the continent,

iii) Create an awareness in the rest of the world about the professional practice in the disciplines in Africa.

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Professor L. O. Amusa                         Tel: +27 15 9628076
Centre for Bio kinetics, Recreation           Fax: +27 15 9628076/9628035
and Sport Science, University of Venda for    E-mail: amusalbw@yahoo.com
Science and Technology, P. Bag X5050,
Thohoyandou 0950
Republic of South Africa

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

PREPARATION OF MANUSCRIPT

Manuscripts should be type written in fluent English (using 12-point Times New Roman font and 1½ line-spacing) on one side of whiteA4-sized paper justified fully with 3cm margin on all sides. Guidelines for Authors 317

In preparing manuscripts, MS-Word, Office 98 or Office 2000 for Windows should be used. Length of manuscripts should not normally exceed 12 printed pages (including tables, figures, references, etc.). For articles exceeding 10 typed pages US$ 10.0 is charged per every extra page. Longer manuscripts may be accepted for publication as supplements or special research reviews. Authors will be requested to pay a publication charge of US$ 350.0 to defray the very high cost of publication. The pages of manuscripts must be numbered sequentially beginning with the title page. The presentation format should be consistent with the guidelines in the publication format of the American Psychological Association (APA) (4th edition).

Title page:
The title page of the manuscript should contain the following information:
Concise and informative title.
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Author(s’) institutional addresses, including telephone and fax numbers.
Corresponding author's contact details, including e-mail address.
A short running title of not more than 6 words.

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

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

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

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

Results
Findings should be presented precisely and clearly. Tables and figures must be presented separately or at the end of the manuscript and their appropriate locations in the text indicated. The results section should not contain materials that are appropriate for presentation under the discussion section. Formulas, units and quantities should be expressed in the systeme 318 Guidelines for Authors internationale (SI) units. Colour printing of figures and tables is expensive and could be done upon request authors’ expense.

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

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

Examples of citations in body of the text:-

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

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

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

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

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


Examples of book references: *Guidelines for Authors* 319

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


Example of electronic references:

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


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The District Operational Director

Department of Education
North West Province
Potchefstroom

REQUEST TO CONDUCT RESEARCH WITHIN YOUR DISTRICT

Dear Sir,

We the researcher from the School of Biokinetics, Recreation and Sport Science are hereby making a request to conduct research in the district under your authority.

To give the background of the study, research revealed that physical activity in adolescents is drastically declining. The decline in the level of physical activity of human populations has been observed, and such decline is been associated with increased mechanization, reliance on technology and urbanization, and the high rate of crime in South Africa and elsewhere in the world. Physical inactivity is thought to be one of the main risk factors for the development of obesity, diabetes, cardiovascular disease, osteoporosis and psychological constraints or risks of behavioural health.

Cross-sectional studies in South Africa which investigate the relationship between physical activity and determinants of cardiovascular disease for children and adults are available.
Findings from these study revealed inactivity was significantly related to the determinants of cardiovascular disease. Little from the abovementioned studies could investigate physical activity and determinants of cardiovascular disease on a longitudinal basis. It is therefore important to note that South Africa is a country of paradox where obesity in children co-exists with malnutrition and many other ailments of health. It is therefore, against this background that a longitudinal study investigating the development and tracking of physical activity and the determinants of cardiovascular diseases in South African adolescents is needed. Adolescence is a time when independence is established, and dietary and activity patterns may be adopted that are followed for many years. Most of the physiological, psychological and social changes within people take place during this period of life. The period of adolescence can be looked upon as a time of more struggle and turmoil than childhood. Adolescents have long been regarded as a group of people who are searching for themselves to find some form of identity and meaning in their lives. Thus, it has great influence on adult fatness and chronic disease of lifestyle as well as long-term outcome on quality of life. If youth health behaviours are tracked during adolescence, it would add support to the primary assumptions given for early interventions to prevent cardiovascular disease as well as delay in cognitive development. For this longitudinal study, tracking is defined as the stability of health behaviours over time, or the predictability of future values by early measurements. From the above given background, therefore, the aims of the study is to investigate over a five year period (2010-2014) a follow-up longitudinal development of physical activity and determinants of health risk factors of health behaviour in 14 years-old adolescents attending schools in Potchefstroom area of the North West Province of South Africa.

The above matter background information refers:

1. Permission is requested to conduct research in selected schools in your district as follows:
   1.1. BA Seobi Sec. School
   1.2. Tlokwe High School
   1.3. Resolofetse High School
   1.4. Botokwa High School
   1.5. Potchefstroom High School for Boys
   1.6. Potchefstroom High School for Girls
   1.7. Hoer Volkskool Potchefstroom
   1.8. Potchefstroom Gimnasium School
2. The targeted groups are boys and girls aged 14 years, in essence the grade 8 learners (NB: the proportion will be as follow: in mixed schools, 35 girls and 35 boys; in blacks schools 30 boys and 30 girls will be required).

3. The targeted term is the first term of 2010 (to be continued during the same term in the subsequent years up until 2014)

4. Items to be assessed or measured are:
   4.1. Demographic information of the selected participants
   4.2. Anthropometric measurements (i.e. body height; weight; skin folds thickness (triceps, sub scapular and calf skin folds), and waist and hip circumferences)
   4.3. Maturation (Tanner questionnaire)
   4.4. Blood pressure measurement (mercury sphygmomanometer)
   4.5. Physical activity questionnaire
   4.6. ActiHeart (heart rate recorder with an integrated omnidirectional accelerometer. It is clipped onto two ECG electrodes worn on the chest.)
   4.7. Health-related physical fitness (i.e. 20m shuttle run, standing broad jump, sit-and-reach, bent arm hang, sit-ups)
   4.8. Social and self-efficacy questionnaire
   4.9. Resting metabolic rate (determined by means of a mobile gas analyser)
   4.10. Blood sampling (i.e. The participants will be requested to fast overnight (10 hours). A fasting sample of 10 ml blood will be taken from each participant in order to obtain ample blood for the various analyses of the study.)
   4.11. Nutritional intake questionnaire.
   4.12. Leisure and recreation constraint questionnaires

5. The schedule of the project will be as follow (Specific dates for selected schools will be finalised per arrangement with the principals concerned):

<table>
<thead>
<tr>
<th>Month and week</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 2010, week 12 – 16</td>
<td>3 hours per child in a selected school</td>
</tr>
<tr>
<td>April 2010, week 19 – 23</td>
<td>3 hours per child in a selected school</td>
</tr>
</tbody>
</table>

Due to the fact that participants will be asked to fast 10 hours without eating breakfast in the morning, therefore sandwiches provision will be made available upon completion of the measurements. The outcomes of this project will benefit the children and the schools with the information regarding the physical activity status and the determinants of health for future.
Hoping for a positive response.

Yours sincerely,

Thank you,

Prof. M. Andries. Monyeki Dr Hanlie Moss
(Principal Investigator, NWU-Potchefstroom) Leader of Niche Area for Physical
Activity, Sports and Recreation, NWU-Potchefstroom
APPENDIX C

INFORMATION LETTER TO THE PARENTS http://www.nwu.ac.za

Dear Parent or Guardian,

Your child has been invited to participate in a study entitled – Five year Longitudinal Study of Physical Activity status and the Determinants of Health in Adolescents attending high school in Potchefstroom areas of South Africa (PAHLS-Study, 2010–2014).

My name is Professor Makama Andries Monyeki (from Potchefstroom Campus of the North-West University) principal investigator in the project together with the research team would like to ask your permission to allow your child (or a child under your care) to participate in our study. To give the background of the study, research revealed that physical activity in adolescents is drastically declining. The decline in the level of physical activity of human populations has been observed, and such decline is been associated with increased mechanization, reliance on technology and urbanization, and the high rate of crime in South Africa. Physical inactivity is thought to be one of the main risk factors for the development of obesity, diabetes, cardiovascular disease, osteoporosis and psychological constraints or risks of behavioural health. Therefore, the purpose of this study is to gather information about physical activity (i.e. by questionnaire & ActiHeart rate monitor) and health determinants (i.e. through measurements of anthropometry, maturation, blood pressure measurement, health-related physical fitness, social and self-efficacy questionnaire, resting metabolic rate, oxygen consumption (by the use of a portable gas analyser apparatus), blood sampling, leisure and recreation constraint questionnaires, nutritional intake questionnaire as questionnaire on risk factors of life) over a period of five years (2010–2014).
Participation in this study is not part of the child’s regular classroom work; it is an optional activity in which the learner can choose to participate. The study will assess and test the following variables: anthropometric measurements, maturation, blood pressure measurement, health-related physical fitness, social and self-efficacy questionnaire, resting metabolic rate, oxygen consumption, blood sampling, leisure and recreation constraint questionnaires, nutritional intake questionnaire as questionnaire on risk factors of life. Blood samples will be collected by a registered professional nurse who will obliged to health profession practices at all times.

The data of the study will be used for research purpose only. The measurements will not be shared with your child classmates or teacher. All information collected in this study will be kept confidential. Your child’s participation is important because the information that shall be gathered on him/her will help him/her with knowledge for personal development and life skills.

Your child participation in the project is very important, but it is entirely your choice. If your child choose to refuse to participate in any part of the study or withdraw from the study at any time, for any reason, this will not cause anyone to be upset or angry, and this will not results in any type of penalty.

There are no costs required from your child (or a child under your care) to participate in the study. Further, no payment will be granted to your child (or a child under your care) for participating in the study.

If you have any question regarding this study, please feel free to call me at (018) 2991790 / e-mail:andries.monyeki@nwu.ac.za or the PHASrec Niche Area Leader Dr Hanlie Moss at (018) 2991821 / e-mail:hanlie.moss@nwu.ac.za. If you have any questions regarding your rights or your child’s rights as participants in this study you can call Ms Hannekie Botha at (018) 299 4850 from Potchefstroom Campus of the North-West University Research Ethics Office.

Thank you, in advance, for considering your child participation in this study. Should you choose that your child participate, please read and sign the attached consent form. Keep one consent form for your records and return the other copy. All received consent form will be kept locked during the entire period of the study. In addition, your child is requested to
bring along his/her birth clinic card. The card will be given back to the child immediately after collecting information on birth date and birth weight. A child who shall have returned a completed and signed consent form will participate in the study.

Sincerely,
Prof. Makama Andries Monyeki
Principal Investigator – PAHLS Study

CONSENT FORM
(Original Copy)


I, .................................................., father/mother/guardian of ...................................... agree to permit my child to provide the information on physical activity (i.e. by questionnaire & ActiHeart rate monitor) and health determinants (i.e. through measurements of anthropometry, maturation, blood pressure measurement, health-related physical fitness, social and self-efficacy questionnaire, resting metabolic rate, oxygen consumption (by the use of a portable gas analyser apparatus), blood sampling, leisure and recreation constraint questionnaires, nutritional intake questionnaire as questionnaire on risk factors of life), by the researchers at my child school. I understand that the results of this study of Five year longitudinal study of physical activity status and the determinants of health in adolescents attending high school in Potchefstroom areas of South Africa (PAHLS-STUDY NWP) will be used for research purpose and nothing else. I am aware that if I have any question or concerns about the study I can contact the researcher at (018) 299 1790 or the PHASRec Niche Area Leader at (018) 299 1821. Any questions or concerns regarding my child rights as a participant in this study can be addressed to Ms Hannekie Botha at (018) 299 4850 from Potchefstroom Campus of the North-West University Research Ethics Office. I understand that there will be no discomfort or foreseeable risks for my child to participate in the study. I understand that all information my child provide will remain strictly confidential. I have read and understand the information provided above and in the information letter. I have been provided with the opportunity to ask questions and my questions have been answered satisfactorily. I consent to have my child participate in the study described above, understanding that he/she may refuse to participate in any part of the study and can withdraw from the study at any time. I have kept one copy of this consent for my records and
will return the second copy with the clinic birth card. I am aware that by giving consent my child can participate in the study. The return consent form will be kept locked during the entire period of the study.

Child’s Age:............................
Grade:..............................
Teacher:..............................
School Name:.................................

Name of Child:..................................................
Name of Parent/Guardian:.............................................

.............................................................. ..............................................................
(Signature of Child) (Signature of Parent/Guardian)

.............................................................. ..............................................................
(Date) (Date)
CONSENT FORM (PAHLS)
(Return this copy with the demographic questionnaire)


I, .................................................., father/mother/guardian of ...................................... agree to permit my child to provide the information on physical activity (i.e. by questionnaire & ActiHeart rate monitor) and health determinants (i.e. through measurements of anthropometry, maturation, blood pressure measurement, health-related physical fitness, social and self-efficacy questionnaire, resting metabolic rate, oxygen consumption (by the use of a portable gas analyser apparatus), blood sampling, leisure and recreation constraint questionnaires, nutritional intake questionnaire as questionnaire on risk factors of life), by the researchers at my child school. I understand that the results of this study of Five year longitudinal study of physical activity status and the determinants of health in adolescents attending high school in Potchefstroom areas of South Africa (PAHLS-STUDY NWP) will be used for research purpose and nothing else. I am aware that if I have any question or concerns about the study I can contact the researcher at (018) 299 1790 /e-mail:andries.monyeki@nwu.ac.za or the PHASRec Niche Area Leader at (018) 299 1821 /e-mail:hanlie.moss@nwu.ac.za. Any questions or concerns regarding my child rights as a participant in this study can be addressed to Ms Hannekie Botha at (018) 299 4850 from Potchefstroom Campus of the North-West University Research Ethics Office. I understand that there will be no discomfort or foreseeable risks for my child to participate in the study. I understand that all information my child provide will remain strictly confidential. I have read and understand the information provided above and in the information letter. I have been provided with the opportunity to ask questions and my questions have been answered satisfactorily. I consent to have my child participate in the study described above, understanding that he/she may refuse to participate in any part of the study and can withdraw from the study at any time. I have kept one copy of this consent for my records and
will return the second copy with the clinic birth card. I am aware that by giving consent my child can participate in the study. The return consent form will be kept locked during the entire period of the study.

Child's Age:............................
Grade:............................
Teacher:..............................
School Name:.............................

Name of Child:.................................................................
Name of Parent/Guardian:..................................................

................................................................. .................................................................
(Signature of Child) (Signature of Parent/Guardian)

................................................................. .................................................................
(Date) (Date)
APPENDIX D

PAHLS Project - Anthropometry Proforma

Subject number: ________________________________

Name: ___________________________________________  Sport: __________________________

Surname first names

Date of Birth: _________ ________ ________

Day Month Year

Test Date: _________ ________ ________

Day Month Year

Box height: ____________________________  Gender: M □ F □

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<tr>
<th>ID</th>
<th>Site</th>
<th>Trail 1</th>
<th>Trail 2</th>
<th>Trail 3</th>
<th>Mean/Median</th>
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<tr>
<td>1</td>
<td>Body mass</td>
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</tr>
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<td>2</td>
<td>Stature</td>
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<tr>
<td>3</td>
<td>Sitting height</td>
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<td></td>
</tr>
<tr>
<td>4</td>
<td>Arm span</td>
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</table>

<table>
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<tr>
<th>Skinfolds (SF)</th>
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<th>Trail 2</th>
<th>Trail 3</th>
<th>Mean/Median</th>
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</thead>
<tbody>
<tr>
<td>5a Triceps : R</td>
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<td></td>
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</tr>
<tr>
<td>5b Triceps : L</td>
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</table>

<table>
<thead>
<tr>
<th>Skinfolds (mm)</th>
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<th>Trail 2</th>
<th>Trail 3</th>
<th>Mean/Median</th>
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<td>6b Subscapular : L</td>
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<td>7b Biceps : L</td>
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<td>8a</td>
<td>Supraspinale : R</td>
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<td>8b</td>
<td>Supraspinale : L</td>
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<td>9</td>
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</tr>
<tr>
<td>10a</td>
<td>Front thigh : R</td>
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<tr>
<td>10b</td>
<td>Front thigh : L</td>
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</tr>
<tr>
<td>11a</td>
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<td>11b</td>
<td>Medial calf : L</td>
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<td>Girths</td>
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<td>Head</td>
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<td>(cm)</td>
<td>Arm (relaxed) : L</td>
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<td>14a</td>
<td>Arm (flexed &amp; tensed) : R</td>
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</tr>
<tr>
<td>14b</td>
<td>Arm (flexed &amp; tensed) : L</td>
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<tr>
<td>15</td>
<td>Waist (minimum)</td>
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<td>Gluteal (hips)</td>
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<td>17a</td>
<td>Thigh (mid) : R</td>
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<tr>
<td>17b</td>
<td>Thigh (mid) : L</td>
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<td></td>
</tr>
<tr>
<td>18a</td>
<td>Calf (maximum) : R</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>18b</td>
<td>Calf (maximum) : L</td>
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<td></td>
<td>Breadths</td>
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<tr>
<td>19</td>
<td>Wrist</td>
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</tr>
<tr>
<td>BR</td>
<td>Ankle</td>
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<td></td>
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<tr>
<td>(cm)</td>
<td>Foot length</td>
<td></td>
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</tr>
<tr>
<td>22</td>
<td>Humerus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Femur</td>
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</table>
### PHYSICAL ACTIVITY QUESTIONNAIRE (PAHLS-IPAQ)

#### A: GENERAL INFORMATION ABOUT YOU

<table>
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<tr>
<th>School:</th>
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<tbody>
<tr>
<td>Grade:</td>
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<tr>
<td>School number:</td>
<td></td>
</tr>
<tr>
<td>Name of the participant:</td>
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<td>Subject number:</td>
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<td>Address:</td>
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<td>Race</td>
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<table>
<thead>
<tr>
<th>Date of Survey</th>
<th>Grade</th>
<th>Sex (mark with an X)</th>
<th>Date of birth</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>dd mm Yy</td>
<td>F/M</td>
<td>dd mm yy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at school, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous/ very hard** activities that you did in the **last 7 days**. **Vigorous/ Very hard** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think **only** about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **very hard** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

    ______ days per week
2. How much time did you usually spend doing very hard physical activities on one of those days?

____ hours per day
____ minutes per day

☐ Don’t know/Not sure

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

____ days per week

☐ No moderate physical activities

☐ Don’t know/Not sure

4. How much time did you usually spend doing moderate physical activities on one of those days?

____ hours per day
____ minutes per day

☐ Don’t know/Not sure

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.
5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

_____ days per week

☐ No walking  ➔ Skip to question 7

6. How much time did you usually spend walking on one of those days?

_____ hours per day
_____ minutes per day

☐ Don’t know/Not sure

The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the last 7 days, how much time did you spend sitting on a week day? (watching TV, Videogames/Internet, Listening to music, reading)

_____ hours per day
_____ minutes per day

☐ Don’t know/Not sure

This is the end of the questionnaire, thank you for participating.