A COMPARATIVE ANALYSIS OF THE NUTRITION STATUS, NUTRITION KNOWLEDGE AND FOOD FREQUENCY OF ADOLESCENTS ATTENDING AN URBAN VERSUS A PERI-URBAN SCHOOL IN HILTON, KWAZULU NATAL

Keiron Audain
210555698

A dissertation submitted in partial fulfillment of the requirements for the degree of
PhD IN DIETETICS AND HUMAN NUTRITION

In the College of Agriculture, Engineering and Science

Supervisor: Prof. Frederick Veldman
Co-Supervisor: Susanna Maria Kassier

November 2014

DECLARATION

This research has not been previously accepted for any degree and is not being currently considered for any other degree at any other university.

I declare that this Dissertation contains my own work except where specifically acknowledged

Keiron Audain (210555698)

Signed… ……

Date……..

ACKNOWLEDGEMENTS

Exceptional thanks to my supervisors Professor Veldman and Mrs Kaisser for their valuable input and support over the duration of this project.

Special thanks to the fieldworkers that assisted me with data collection

Thanks to Mr. Sam Nkosi and the principals of both schools for their cooperation and assistance

To my mother, family and close friends for their unwavering support and encouragement before, during and beyond this time

Last but certainly not least – thank you to all the adolescents that volunteered to take part in this study – your contributions to improving the current nutrition climate will not go unnoticed.

ABSTRACT

Adolescence is an important stage in human development. Optimum nutrition is crucial during this period, as additional nutrient requirements are needed to promote growth and maturation. With the nutrition transition in low-to-middle-income countries (LMICs), adolescents are increasingly exposed to energy-dense, nutrient poor foods; however it is not entirely clear the impact of socioeconomic status, in particular household food insecurity, on the consumption frequency of these foods. The impact nutrition knowledge may have on the dietary choices adolescents make is also unclear. Poor food choices among adolescents can contribute towards overweight/obesity and stunting, leading to the susceptibility to both communicable and non-communicable diseases (NCDs) in adulthood.

The objective of this study was to determine the prevalence of overweight/obesity and stunting among South African adolescents from different socioeconomic backgrounds, in relation to their nutrition knowledge, household food insecurity status, and frequency of food consumption.

The study consisted of a cross-sectional descriptive survey conducted among learners from a high-income, private urban school and a low-income, government peri-urban school in Hilton, KwaZulu-Natal. A total of 98 grade nine to eleven learners from the urban school and 111 grade nine to eleven learners from the peri-urban school volunteered to participate (N= 209).

Nutritional status was determined by anthropometric measurements that included weight, height and MUAC. Subsequently BMI was calculated. Nutrition knowledge and food frequency were determined via non-quantified nutrition knowledge and food frequency

questionnaires. A socio-demographic questionnaire (SDQ) was used to collect information on parental level of education and employment status. Household food security was determined using the Household Food Insecurity Access Scale (HFIAS).

A higher prevalence of overweight and obesity was observed among urban learners compared to their peri-urban counterparts, however only for the boys as peri-urban girls had a notable prevalence of overweight and obesity compared to urban girls. Stunting was present among peri-urban learners but virtually absent in their urban counterparts, which was indicative of a double-burden of overweight/obesity and stunting within the peri-urban group. Peri-urban learners had parents with lower education and employment levels compared to urban learners. Adolescents with mothers that were educated up to tertiary level were associated with a higher nutrition knowledge scores (NKS). Urban learners had a higher mean NKS than peri-urban learners; however it did not necessarily reflect healthier food choices, as urban learners had a high consumption frequency of fatty red and processed meat, white bread and fizzy drinks. Peri-urban learners reported a higher preference for deep-fried, high-fat snacks such as vetkoeks and samosas; which may be related to the high levels of household food insecurity that was noted. Among grade ten peri-urban learners, 50% reported having no food to eat of any kind in the household, with 5% reporting that it occurred often.

Poor dietary habits among adolescents in general were observed in this study; although food sources varied between urban and peri-urban learners possibly due to differences in cost and availability of food items. A lower SES was an underlying factor for the consumption of energy-dense foods among peri-urban learners; while a higher SES was associated with the consumption of more expensive fatty foods among urban learners. Thus, the risk of malnutrition (overweight/obesity and stunting) and subsequent disease susceptibility is present in both groups as a result.

TABLE OF CONTENTS

ABBREVIATIONS

AIDS: Acquired Immune Deficiency Syndrome

BMI: Body Mass Index

cm: centimetre

CVD: Cardiovascular disease

DALY: Daily Adjusted Life Years

DoE: Department of Education

FBDG: Food-Based Dietary Guidelines

FFQ: Food Frequency Questionnaire

HIV: Human Immunodeficiency Virus

HFIAS: Household Food Insecurity Access Scale

ISAK: International Society for the Advancement of Kinanthropometry

kg: kilogram

KZN: KwaZulu-Natal

LMICs: Low-to-middle-income-countries

m: metre

MRC: Medical Research Council

MUAC: mid-upper arm circumference

NCD: Non-communicable Disease

NFCS: National Food Consumption Survey

NKS: Nutrition Knowledge Score

SAD: Standard American Diet

SADHS: South African Demographic and Health Survey

SANHANES: South African National Health and Nutrition Examination Survey

SES: Socio-economic Status

SD: standard deviation

SDQ: Socio-demographic Questionnaire

SPSS: Statistical Package for the Social Sciences

UKZN: University of KwaZulu-Natal

UN: United Nations

UNICEF: United Nations Children's Fund

UNFPA: United Nations Population Fund

WHO: World Health Organisation

LIST OF TABLES

Chapter 5

CHAPTER 1
INTRODUCTION

Background

Olivier De Schutter, special rapporteur to the United Nations (UN) on the human right to food, stated that unhealthy diets are now "a greater threat to global health than tobacco"(Healy. 2014). Middle income countries like South Africa are undergoing a nutrition transition, leading to changes in dietary habits (Popkin *et al*., 2012). As a result of the nutrition transition many national food supplies in LMICs have become unhealthier, with energy-dense foods high in saturated fat, sugar and animal protein replacing traditional diets consisting of nutrient-dense foods such as fruits, vegetables and whole grains; which may lower the risk of obesity and non-communicable diseases (NCDs) as such foods have a better nutrient-to-energy ratio (Khoury *et al*., 2014; Temple and Steyn, 2011).

Obesity is recognized as a chronic disease (World Health Organisation (WHO) 2004) and is now considered a global epidemic that has begun to emerge in low and middle-income countries (LMICs); primarily due to urbanisation and the resultant nutrition transition (Swinburn *et al*., 2011).In addition, obesity is also strongly associated with NCDs such as cardiovascular disease (CVD), type-2 diabetes, dyslipidaemia (high blood cholesterol) and hypertension (Van Der Merwe and Pepper, 2006)..

Adolescence is a critical stage in human development, marked by both biological and social changes (Belachew *et al*., 2012). Consequently, adolescents are particularly affected by food insecurity, as adolescence represents a period of rapid growth, and additional energy and nutrients are required. It has been hypothesized that adolescents from low income households are more likely to experience chronic food insecurity (Belachew *et al.*, 2012).

In countries that experience high rates of poverty, decisions regarding food purchases are often based on cost rather than health, and whilst nutrient-dense foods such as fruits,

vegetables and whole grain may contribute to better health, they are generally considered to be more expensive than energy-dense albeit nutrient-poor foods such as cakes and sweets (Temple *et al*., 2010). Also, with the spread of globalization and growing preferences for more "globalised diets", there may be a tendency, particularly among adolescents, to perceive healthier foods to be not as tasty as unhealthy foods, even when the healthier foods are more affordable (Temple *et al.,* 2010). This is exacerbated by the relatively cheap and widespread availability of poor quality foods that appeal to adolescents owing to their taste and affordability (Temple and Steyn, 2011). In addition, adolescents are regularly exposed to media advertising as well as peer influence at school, which significantly impact on their perception of food and frequency of food consumption (Williams, 2013; Grosso *et al*., 2012). It has been highlighted that adolescents may be more likely to consume unhealthy foods such as snacks and other fast foods when eating with peers as opposed to when consuming food at home (Bargiota *et al*., 2013). In addition to dietary habits, factors including sedentary behaviour and low levels of physical activity also contribute to obesity prevalence among adolescents (Sedibe *et al.*, 2014a). According to the SANHANES-1 study, approximately 50.2% of South African participants aged 18-24 years were considered inactive (Shisana *et al*., 2013). Reasons highlighted for a lack of physical activity among low-income adolescents in South Africa included a lack of facilties and safety conerns within the community (Sedibe *et al*. 2014b). The challenge of changing dietary habits as a disease prevention strategy among adults is difficult. Hence encouraging these changes during adolescence should be considered as independent dietary habits that are usually formed at this stage in an individual's life (Coovadia, 2009). Some of the factors that impact on the nutritional status of adolescents include socioeconomic status (SES) and the frequency of consumption of various foods. Also, although to date there has been little association made between nutrition knowledge and nutritional status in adolescents, it is still believed to play an important role;

as poor nutrition knowledge can lead to the adoption of poor dietary behaviour, resulting in poor health in adulthood (Grosso *et al*., 2012).

Problem Statement

Although some individuals may be at an increased risk for the development of obesity due to genetic factors, the dramatic increase in the prevalence of obesity over a relatively short period of time implies that the obesity epidemic is also influenced by environmental factors including diet, socioeconomic status (SES), and urbanisation (Rossouw et al,. 2012; Stevens *et al*., 2011).

Sub-Saharan Africa has approximately 23% of the global adolescent population (UNICEF, 2012). In South Africa, an estimated 20% of the total population are between the ages of 10 and 19 (UNFPA, 2012). According to the South African National Health and Nutrition Examination Survey (SANHANES-1), only 4.6% of the adolescent population consumed the recommended guidelines for fruits and vegetables **(**Shisana *et al*., 2013**)**.

The SANHANES-1 found that 11.9% of girls at birth to 14 years of age were overweight and 4.8% were obese, whereas overweight was present in 24.9% of women 15 years and older while 39.3% were obese (Shisana *et al*., 2013). In fact, South Africa has the highest prevalence of overweight (69.3%) and obesity (42%) among women in Sub-Saharan Africa, even surpassing that which is reported for women in the United States (Ng *et al*., 2014). It was also observed that mean weights in adolescents were higher in urban areas compared to non-urban areas, which was particularly noted in Black South African adolescents (SADHS, 2003).

The preference for globalised, energy-dense foods and the onset of obesity are significant risk factors for the development of NCDs (Khoury *et al*., 2014; Amuna and Zotor, 2008). Energy-dense foods provide a less expensive alternative for meeting energy requirements but lack

key nutrients necessary for sustaining optimum health (Temple and Steyn, 2011). Individuals on a limited budget may make food procurement decisions based on cost rather than health, and often consume larger quantities of these foods to curb hunger (Temple and Steyn, 2011). Thus whilst the nutrition transition may have enabled low-income households to have increased access to more affordable globalised foods; overall diet quality has deteriorated (Temple and Steyn, 2011). These alterations are believed to contribute to the growing obesity epidemic observed among adolescents. Globally, it was estimated that NCDs contribute to 48% DALYs lost (Bloom *et al.,* 2011). In addition, NCDs are responsible for an estimated 36 million deaths annually, 80% of which occur in LMICs and are caused by cardiovascular diseases (CVDs), respiratory diseases, diabetes, and various cancers (WHO, 2013b).

Another consequence of food insecurity is undernutrition, the long-term consequences of which may include poor physical and mental development into adolescence and adulthood. Stunting, believed to be an indicator of chronic undernutrition, is defined as low height for age (Garcia *et al*., 2012). Nutrient deficiencies can lead to poor cognitive development, which will affect academic performance and eventually produce a substandard labour force. This in turn can affect the economic growth of a country, as it carries the risk of repeating the cycle of poor nutrition, as undernourished mothers will most likely give birth to undernourished children, thus compromising their growth and altering their body composition, brain development, and metabolic programming. These alterations not only affect cognitive development and educational ability, but also increase susceptibility to infection and disease (Chang *et al*., 2002).

In LMICs such as South Africa, the prevalence of stunting and overweight/obesity were found to co-exist, particularly when incorporating factors such as communicable diseases (Kimani-Murage, 2010). Whilst the communicable disease burden was significantly reduced prior to the onset of obesity and NCD epidemics in industrialised countries, it remains highly

prevalent in LMICs as a result of food insecurity and underdevelopment (Amuna and Zotor, 2008). Hence, many low income countries now face a double burden of both communicable and NCDs (Black *et al*., 2013; Shetty 2013; Bygbjerg, 2012). For example, in 2010 over 2.06 million deaths in Sub-Saharan Africa were attributed to NCDs, presenting a 46% increase over a decade. During the same period, deaths due to communicable diseases increased by 17% (Naghavi and Forouzanfar, 2013).

The prevalence of NCDs in LMICs are believed to soon reach epidemic proportions and equal if not surpass that of communicable diseases by 2025 (Khoury *et al.*, 2014; Adeboye *et al*., 2012).

Socioeconomic status (SES) is possibly the most direct contributor to food insecurity. Urbanisation can often lead to a change from a traditional rural diet to an urban diet, which is often characterised by a higher consumption of animal-derived foods, refined flour, sugar and sodium (Dolman *et al*., 2013). It is important to take cognisance of the level of nutrition knowledge of adolescents in LMICs.

In South Africa, there has been a growing emphasis on promoting good dietary practice and exercise among adolescents, however the overall consumption of unhealthy, energy-dense foods remains high and appears to be increasing (Letlape *et al.*, 2010). This has been linked to poor nutrition knowledge and its relationship to good health. It is feared that such dietary trends among adolescents can lead to irreversibly morbid outcomes for future adults (Letlape *et al.*, 2010). Thus, assessing nutrition knowledge in relation to nutritional status and frequency of food consumption in adolescents particularly against a socioeconomic backdrop can play a functional role in effective intervention design.

Methodology

Study Design

This study utilised a cross-sectional, descriptive design in order to investigate and describe the nutritional status, food frequency and nutritional knowledge of participating adolescents. A cross-sectional design was applied to research that required observations to be made at a single point in time. A descriptive design allowed for the detailed profiling of a population, as well as an accurate description of a relationship or process occurring within the population.

Study Population

For the cross-sectional description section of this study, the study population involved 209 adolescent learners from two secondary schools based in Hilton. Hilton is a small town situated on the outskirts of Pietermaritzburg in KwaZulu-Natal. The first school was an urban private school, and the second was a government school based in a peri-urban setting. Both schools varied in relation to the SES of the learners. The urban school consisted of a more diverse learner population (African, Indian, White and Coloured), and the peri-urban school consisted of predominantly Black students.

Sample Selection

Based on statistical relevance, a sample size of 209 grade 9-11 learners were included in this study, 98 from the urban school and 111 from the peri-urban school. In the urban school, the sample size was stratified according to ethnicity in order to investigate the impact of cultural identity on nutrition knowledge. The method of sampling used in this study was convenience sampling, based on the convenience and ease of access to the sample participants. Although requiring considerable less effort, one limitation of this method was that it may not be a full representation of the entire population.

Data Collection

Data was collected from learners within a classroom setting at both schools between June and August 2013. The entire process was relatively straightforward as data was collected in an orderly classroom setting with teacher supervision. All participants were briefed on the study objectives in either English or isiZulu, and asked to sign an informed consent form.

Closed-ended questionnaires were given out for participants to complete. The nutrition knowledge questionnaire (NKQ) consisted of 42 multiple choice questions, which were chosen based on their suitability for a thorough investigation into the nutrition knowledge of the sample learners. The NKQ was developed specifically for the assessment of nutrition knowledge in adolescents aged 13 to 19 years old (Whati *et al.,* 2005). The development process involved identification of nutritional concepts in accordance with the South African national teaching curriculum and the South African Food-Based Dietary Guidelines (FBDGs) (Vorster *et al.,* 2013). A full description is provided in chapter three. The NKQ initially consisted of 140 questions, which were then narrowed down to 88 questions after content and face validity assessment by an expert panel. These were then piloted to adolescents aged 13 to 14 years to assess the level appropriateness and understanding for non-experts; followed by a second piloting with an expert versus and non-expert group to assess construct validity and perform item analysis. The end result was the development of a questionnaire consisting of 63 questions (Whati et al. 2005). During this process it was found that learners from grade eight or younger as well as learners with a low SES generally required assistance with completing the questionnaire; which was taken into consideration for this study. As a result, grade eight learners were not included in the study and fieldworkers were specifically trained to provid assistance to learners from the lower-income peri-urban school. Prior to data

collection, the NKQ was piloted among five random grade 10 students at the urban and peri-urban school.

Household food insecurity was assessed by the Household Food Insecurity Access Scale (HFIAS) questionnaire, which consisted of nine questions (each with a follow-up question).

The HFIAS questionnaire investigated whether or not the household experienced one or more types of food insecurity in the past four weeks, and if so, with what frequency. The HFIAS score measures the extent of food insecurity. Each question consists of two parts. Part A contains two possible responses of "yes" and "no", and Part B ("How often did this happen?") contains three possible responses of "rarely", "sometimes" or "often". The score ranged from 0-27, and the higher the score, the greater the extent of household food insecurity. The HFIAS-related conditions provide an indication of the percentage of households experiencing a specific condition in accordance with the possible responses of "rarely", "sometimes" or "often". A full description is provided in chapter five.

It has been noted that strong correlations exist between measures constructed in the HFIAS and commonly known poverty and food consumption indicators used in the monitoring of various issues related to food security (Coates *et al*., 2007). The scale also took into consideration socioeconomic changes that may occur in the household over time, thus increasing its validity and usefulness in impact assessments (Coates *et al*., 2007). However, there remains room for further validation as the questionnaire is applied to various sample groups, which will essentially testify to the universality of the scale (Coates *et al*., 2007). The HFIAS questionnaire was adapted and validated for use among adolescent learners in this study. Prior to data collection, it was piloted among five random grade 10 students at the urban and peri-urban school to ensure its adaptability to an adolescent population.

The Food Frequency questionnaire (FFQ) was designed by six South African dietitians for the purpose of determining the eating habits and traditional food consumption of urban Zulu

women (Kassier, 2014). It was adapted and validated for use among adolescent learners in this study. The FFQ provided eight consumption choices for 61 foods. The food items were grouped into eight categories according to the similarity of nutritional content as follows: starches, vegetables, fruit, dairy, meat, fast food or takeaways, snacks and drinks.

The FFQ method was chosen to measure food consumption in the sample groups due to its ease of use and low cost. However, concern was raised with regards to its reproducibility, which is described as the "consistency of data obtained in more than one administration of the same instrument to the same subject at different times" (Filippi *et al.*, 2014). Owing to the huge variations in dietary habits in different populations, the FFQ requires specific tailoring in order to fit the target sample population (Nurul-Fadhilah *et al.*, 2012). Admittedly, limited information exists to assess the validity of FFQ used among South African adolescents. For the purpose of this study, the FFQ used was piloted among five random grade 10 students at both the urban and peri-urban school on different occasions to confirm its reproducibility among the sample adolescent populations.

The socio-demographic questionnaire (SDQ) was developed for the purpose of this study and collected information on parental education, employment status and general household living situation. The SDQ did not collect data on income levels.

All questionnaires were piloted to five random grade 10 students at the urban and peri-urban school to ensure simplicity and straightforwardness. All questionnaires were translated into isiZulu for the benefit of learners with difficulty in reading and understanding English at the peri-urban school. A total of 209 completed questionnaires (98 from the urban school, 111 from the peri-urban school) were gathered from both schools and included in the study.

Anthropometric data of learners were measured, including height, weight and mid-upper arm circumference (MUAC). Instruments used included the height-stick measure, Seca 214

Leicester portable stadiometer, and the Seca 813 heavy duty floor scale. The body mass index (BMI) was then calculated from the height and weight data collected.

Learners were required to remove their shoes and hair ornaments, and stand straight against a vertical backboard with feet flat and heels, back and shoulders against the board, with the head in the Frankfort position for height measurements, which was recorded in centimetres (cm). All shoes and heavy objects were removed for weight measurements, which were recorded in kilograms (kg) to the nearest 100g, and learners were required to stand still over the center of the scale.

Measuring the MUAC involved locating and marking the acromium process on the left shoulder, and bending the elbow at a 90^{o} angle with palm facing upwards. The distance from the mark to the tip of the elbow was then measured. Once the mid-point was located, learners were instructed to relax their left arm, and a measuring tape that touched the skin without compressing the tissues was passed over the midpoint, and MUAC was measured to the last completed millimetre (mm).

Inclusion Criteria

Participant inclusion criteria of the study include the following:

- Male and female adolescents.
- Grade 9-11 learners attending the urban and peri-urban school.
- English and Zulu speaking learners.

Exclusion Criteria

Participant exclusion criteria of the study include the following:

- Grade 8, and 12 learners.
- Learners not attending the urban and peri-urban school.

Assumptions

For the purpose of the study, researchers assumed that all learners participating in the study responded sincerely and truthfully.

Reliability and Validity of Data

To ensure data validity and reliability, a clear stipulation of research methods and procedures used was given to ensure that those accessing the study at a later stage would be able to benefit from the results and utilise the protocol to conduct similar investigations if desired. In order to ensure validity of results and accuracy of analysis, steps were taken to control all possible factors that may affect validity such as flaws within the study including its design and data collecting instruments/methods used. To increase accuracy and validity of anthropometric data, weight and height measurements were measured in duplicate and an average of the both results will be recorded. Subsequent to data collection, all 209 questionnaires were considered complete and included in the study sample, as they contained all crucial information needed for data analysis.

Field Worker Recruitment and Training

The study required ten fieldworkers to assist with the data collection due to the relatively large sample size of the adolescent cohorts. The field workers were recruited on the basis that they were 4th year Dietetic students who were all bilingual (English and isiZulu) and trained appropriately in the administration of questionnaires in the classroom setting without introducing interviewer bias and in taking accurate anthropometric measurements. In addition, training was given on the purpose of the study and the importance of achieving research objectives. In the urban school, three fieldworkers collected data from each grade

(nine, ten and eleven) over a period of three days. In the peri-urban school, all ten fieldworkers (four in grade nine, three in grades ten and eleven) collected data in one day.

Statistical Analysis

The results from the questionnaires and were analysed using Statistical Package for the Social Sciences (SPSS)® 19. Statistical associations between the categorical variables were analysed using Descriptive statistics, Pearson correlation coefficients and chi-square tests. A p-value of 0.05 was considered to be significant.

Reduction of Bias

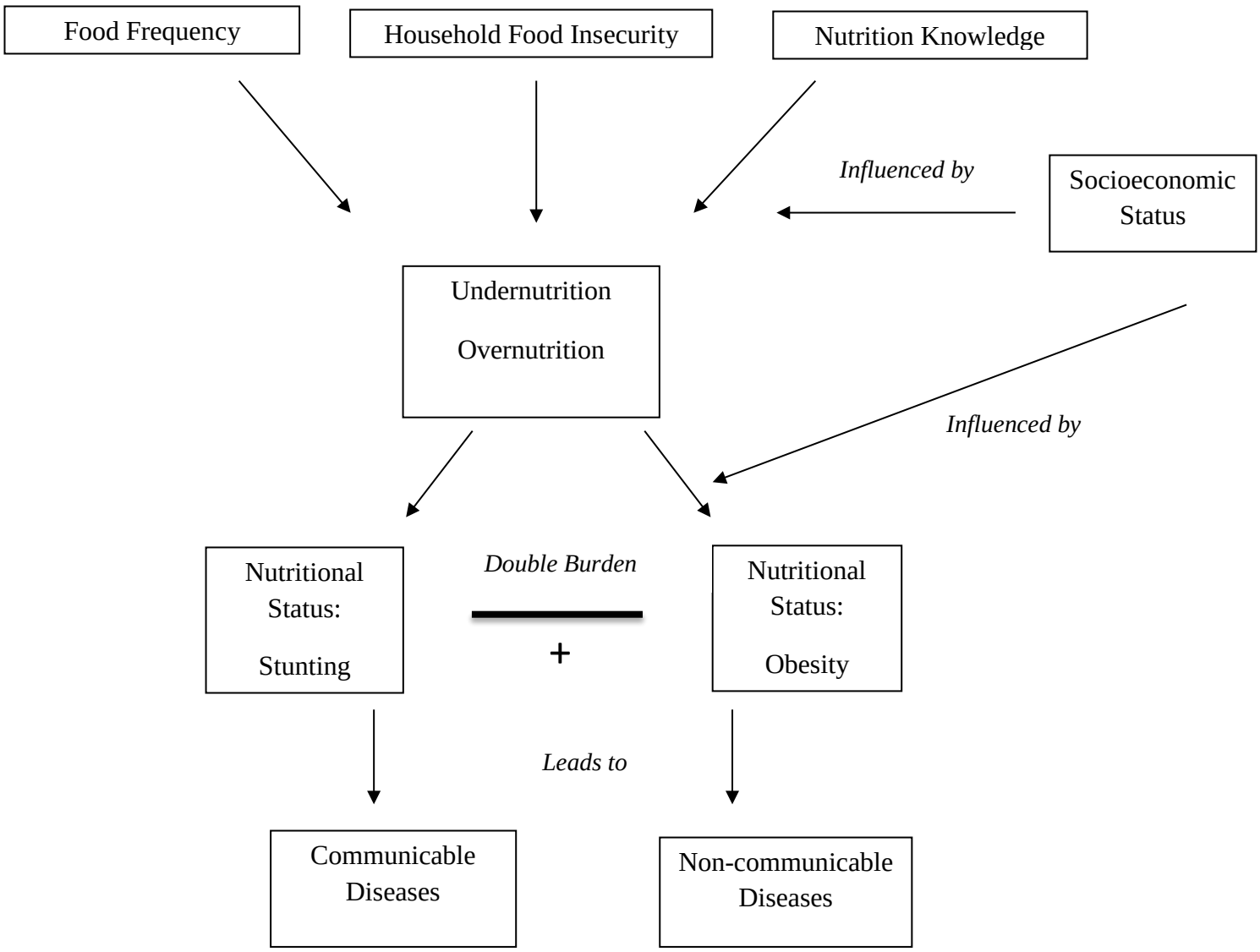
The following precautions will be made to reduce bias in this study:

- Questionnaires for the adolescent cohort were done separately and anonymously
- Questionnaires were designed so as not to induce respondent fatigue.
- Field workers were sufficiently trained to administer questionnaires and take accurate anthropometric measurements
- Anthropometric measurements were taken twice and the average of the two recorded.

Conceptual Framework

It is possible that a double burden of stunting and obesity may have emerged in LMICs that have undergone a nutrition transition such as South Africa (Amuna and Zotor, 2008; Kruger et al., 2005). The fact that the majority of research has not analysed its impact on adolescents as a separate age group, is of particular concern, as adolescence represents a crucial stage in the growth and development of an individual (Gandy, 2014; WHO, 2005). Most attitudes and opinions towards food as well as eating habits are formed during this stage of the lifespan, which in turn may contribute to long-term susceptibility to poor nutritional status and both communicable and non-communicable disease onset (Zingoni *et al*., 2009).

It is therefore of importance to investigate the presence and impact of this double-burden on adolescent populations, in particular how it may be affected by SES, as adolescent BMI is known to track into adulthood. Available research suggests that indicators including food frequency (Stupar *et al*., 2012), household food insecurity, and nutrition knowledge (Letlape *et al*., 2010) can affect the nutritional status of adolescents. The assessment of the above variables can therefore assist with the development of an appropriate intervention to improve nutritional status among adolescents (Zingoni *et al*., 2009).



Research Questions

1. What is the prevalence of obesity and stunting amongst adolescents of different SES?
2. Is there a coexistence of obesity and stunting among adolescents of the same SES?
3. How do factors such as household food insecurity status, food frequency and nutrition knowledge influence nutritional status?

Research Objectives

The objectives of this study were to determine and compare the level of nutrition knowledge, food frequency and nutritional status among male and female adolescents of different socioeconomic status (SES).

Specific objectives include:

- Determine and compare the level of nutrition knowledge of grade nine to eleven learners from an urban and a peri-urban co-ed school using a nutrition knowledge questionnaire;
- Determine and compare the food frequency of grade nine to eleven learners from an urban and a peri-urban co-ed school using a food frequency questionnaire;
- Determine and compare the nutritional status of grade nine to eleven learners from an urban and a peri-urban co-ed school by collecting anthropometric data;
- Determine the relationship between nutrition knowledge, food frequency, household food insecurity status and nutritional status in the urban and peri-urban schools

Definitions

- Adolescence: the developmental stage of individuals aged 10 to 19 years (UNICEF, 2012).
- Globalised foods: Energy-dense foods that are widely available globally and often replace traditional foods (Khoury *et al*., 2014).
- Nutrition transition: The shift in dietary consumption and energy expenditure that coincides with economic, demographic, and epidemiological changes.
- Nutrition Knowledge: Refers to pupils', teachers' and parents' knowledge in the following areas: food nutrients; balanced diet; deficiency diseases; food preservation; storage hygiene and nutritional requirements for different groups.
- Nutritional status: the extent to which nutrients are available to meetmetabolic needs; the assessment of the state of nourishment of an individual
- Obesity: an accumulation of fat to an excess where it may contribute to severe health consequences (Rossouw et al., 2012); a person with a BMI above 30 kg m^{-2} (WHO, 2013).
- Stunting: An indicator of chronic undernutrition; low height for age (Garcia *et al*., 2012); a height-for-age more than two standard deviations (z-scores) below the median of the WHO international reference (WHO, 2013).
- Undernutrition: A net energy deficit occurring in either the presence or absence of additional nutrient deficiencies; varies according to the severity, duration and age of the deficit (Garcia *et al*., 2012).

Structure of dissertation

This dissertation contains six chapters, and in this chapter (Chapter one) the study background, problem statement, research objectives, research questions, conceptual framework and methodology of the study, as well as the structure of the dissertation were given.

In the second chapter, a review of literature is presented, which highlights the importance of adolescent nutrition as a well as the factors affecting nutritional status. This literature review was submitted for publication.

Chapter three contains a research article that compares the nutrition knowledge and SES of adolescent learners at both schools, which was submitted to the international journal Public Health Nutrition. Chapter four contains a research article that compares the nutritional status of adolescent learners, which was accepted for publication in the African Journal of Food, Agriculture, Nutrition and Development (AJFAND). Chapter five contains a research article that examines the food frequency and household food insecurity of adolescents, which was published in the South African Journal of Clinical Nutrition (SAJCN); and its abstract presented at the 6th African Nutrition Epidemiology Conference (ANEC) in July 2014. Finally in Chapter six the conclusions and recommendations based on the findings of the study are made.

Authorship

In chapters one to six, Frederick Veldman was the final editor. Susanna Kassier was the initial editor and contributed information on the Food-Based Dietary Guidelines, as well as validation information for the food frequency and socio-demographic questionnaires. Keiron Audain drafted all chapters, conducted the literature review (chapter two) and analysed and discussed the results in the conclusion (chapter six).

In Chapters three to five, Frederick Veldman was the final editor and contributed to the statistical analyses of data presented in the results section. Susanna Kassier drafted the methodology sections and was the first editor. Keiron Audain drafted the introductions as well as conducted the data analysis and interpretation in the discussions and conclusions.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The effects of globalisation have resulted in low-to-middle-income countries (LMICs) such as South Africa undergoing a nutrition transition, where the diets have shifted from traditional to more "globalised" foods (Shetty 2013; Popkin *et al*., 2012). This has led to an influx of energy-dense but nutrient-poor foods even in low-income areas due to their increased availability and affordability (Shetty 2013; Popkin *et al*., 2012; Stupar *et al*., 2012). In high-income countries, the change from communicable to non-communicable disease (NCD) epidemics including obesity, diabetes, cardiovascular diseases (CVDs), hypertension and various cancers has been reflective of industrialisation as was evident at the at the beginning of the twentieth century (Bygbjerg, 2012; Amuna and Zotor, 2008). However, in LMICs an increase in the prevalence of NCDs has occurred without a concomitant decrease in communicable diseases such as malaria, tuberculosis (TB) and HIV; thus, resulting in a double-burden of disease (Bygbjerg, 2012; Amuna and Zotor, 2008). This is a major public health concern given the largely inadequate healthcare systems present in low-income countries (Pearson and Jordan, 2010). It is estimated that only 76 doctors per 100,000 of the population are available in low-income countries, compared to 253 doctors per 100,000 in high-income countries (Pearson and Jordan, 2010). In addition, poor infrastructure including improper sanitation, road systems and electricity supplies further hamper the availability of optimum healthcare (Pearson and Jordan, 2010). Thus an increase in disease burden will inevitably lead to a higher incidence of morbidity and mortality.

In LMICs countries, the nutrition transition is especially evident amongst adolescents, who are usually the most exposed to globalised foods via mass media advertisements (Stupar *et al*., 2012; Aounallah-Skhiri *et al*., 2011). Worryingly, the recent onset of globalisation means adolescents of this generation will be exposed to obesogenic environments at an earlier and a longer period than previous generations, thus increasing their risk of future health problems including NCDs (Aounallah-Skhiri *et al*., 2011). Also, it is believed that adolescents in Sub-Saharan Africa have the poorest health profile and may possess the highest risk for future development of NCDs; as in addition to poor dietary habits, other risk factors such as sedentary behaviour and tobacco use are on the rise (Patton *et al*., 2012).

Generally, adolescents are perceived to be healthy compared to adults (Patton *et al*., 2012); however, from a nutritional perspective adolescence is a critical stage of the life span, as it is characterised by rapid growth (Belachew *et al*., 2012). Therefore, poor dietary habits and inadequate food intake among adolescents can lead to poor growth and development (Belachew *et al*., 2012). Nutrient-deficient adolescents may be more susceptible to communicable diseases (Krawinkel, 2012), as well as have an increased susceptibility to NCDs (Rosenquist, 2013; Caprio, 2012).

This literature review highlights the association between nutritional status and disease burden among adolescents, including communicable diseases and NCDs; and the importance of adolescent nutrition in future disease risk. It also highlights existing research related to some of the factors that impact on the nutrition status of adolescents in low-income countries, including urbanisation, dietary diversity, gender, socioeconomic status (SES), and nutrition knowledge.

2.2 Nutrient Deficiency and Disease

Undernutrition is characterised by a net energy deficit occurring in either the presence or absence of additional nutrient deficiencies and varies according to the severity, duration and age of the deficit (Garcia *et al*., 2012). Stunting is believed to be an indicator of chronic undernutrition, and is defined as low height for age (Garcia *et al*., 2012), or as having a height-for-age more than two standard deviations (z-scores) below the median of the WHO international reference (WHO, 2013). The onset of stunting has been associated with micronutrient deficiencies including zinc, vitamin A and iron, all of which are believed to play a role in linear growth and immune function (Wessells and Brown, 2012; Ejaz and Latif, 2010). Zinc for example, is an important nutrient that supports the immune response, bone metabolism and growth hormone and insulin-like growth factor-I systems (Roohani *et al*., 2013; Wessells and Brown, 2012). Undernourished individuals are thus more likely to acquire communicable diseases and less likely to recover from one (Krawinkel, 2012). This creates a cycle of ill health, as disease-related energy loss can increase undernutrition, while nutrient-related immune failure can exacerbate communicable disease susceptibility (Krawinkel, 2012).

Micronutrient deficiencies can also lead to increased risk to NCDs such as CVDs and diabetes (Rosenquist, 2013). For example, folate deficiency may elevate homocysteine levels in serum, which is a known risk factor for heart disease (Rosenquist, 2013). Also, given the structural relationship between zinc and insulin, zinc deficiency may play a role in the onset and severity of insulin resistance and therefore be related to the development of metabolic syndrome (Roohani *et al*., 2013). It has been reported that combinations of TB and diabetes were found in the same individual, possibly owing to the multiplicity of micronutrient deficiency in disease (Bygbjerg, 2012).

Obesity is characterised by an accumulation of body fat to an excess where it may contribute to severe health consequences (Rossouw *et al*., 2012). Based on the WHO definition, a person with a BMI above 25kg m^{-2} is considered overweight, and above 30 kg m^{-2} is considered obese (WHO, 2013). Overweight and obese individuals are at risk of developing metabolic syndrome, which is marked by increased waist circumference, hypertension, and glucose intolerance; which can increase susceptibility a range of NCDs, including CVDs, diabetes and various cancers (Caprio, 2012).

Based on increased nutrient requirements and overall poor dietary habits, it is largely perceived that NCD susceptibility may have its origins in adolescence (Aounallah-Skhiri *et al*., 2011). Among adolescents, obesity is also associated with psychological problems such as depression, poor self-esteem and self-worth, and isolation which can affect psychological well-being (Zingoni *et al*., 2009). For instance, overweight and obese adolescents may choose not to participate in physical activity due to fear of discrimination and social rejection (Rossouw *et al*., 2012).

In South Africa, it has been observed that stunting and obesity may coexist within the same population, particularly in areas characterised by high levels of poverty and unemployment (Kimani-Murage *et al*., 2010). A study conducted by Kimani-Murage (2013), involving 3,489 rural South African children aged one to 20 years from the Mpumalanga Province found the coexistence of childhood stunting and adolescent obesity. The prevalence of stunting was most evident among males aged 14 to 15 years at 15%. Underweight was highest among 14 year old boys at 19%. Overweight and obesity increased with age and was highest in adolescents aged 15 to 20 years at 12%. This was especially noted among girls, with a prevalence of up to 25% in 18 year olds. Significant predictors of overweight and obesity during adolescence were gender, age, SES, household food security, and the mother's age and level of education.

2.3 Adolescent Nutrition

Adolescence is defined as the developmental stage of individuals aged 10 to 19 years (UNICEF, 2012). It represents the transition from childhood into adulthood including social, psychological and physiological changes from the onset of puberty (Mesias *et al*., 2013; WHO, 2005). According to Coovadia's Paediatric and Child Health (2009), the adolescent stage can be characterised into early, middle and late adolescence; with early adolescence (between 10 and 14 years) being marked by maximum somatic and sexual growth. The significant growth spurt observed during adolescence is second only to the first year of life (Mesias *et al*., 2013; Mesias *et al*., 2011; WHO, 2005). During this period, additional amounts of energy, macronutrients and micronutrients including iron and calcium are required for adequate growth and development (Mesias *et al*., 2013; Mesias *et al*., 2011). It is reported that approximately 40-50% of adult weight and 15–25% of adult height is attained during adolescence (Mesias *et al*., 2013; WHO, 2005), as well as an increase in bone and muscle production and total blood volume (Mesias *et al*., 2013). In addition, the storage of adipose tissue has been shown to increase rapidly during adolescence, thereby making it a critical period for the development of obesity (Gandy, 2014). A consistently inadequate diet, including the regular consumption of non-nutritious foods, can eventually lead to nutrient deficiencies (Belachew *et al*., 2012), which is particularly consequential during adolescence as it can lead to developmental problems such as delayed and inadequate growth (Mesias *et al*., 2013; Mesias *et al*., 2011; WHO, 2005). In addition, the resulting nutrient deficiencies , has been linked to a variety of behavioural problems during adolescence including depression, poor attention span, late-coming and/or absenteeism from school, as well as poor academic performance (Chaparro *et al*., 2009). As a result, learning ability may be disrupted, leading to unemployment and/or poor job placement upon completion of secondary education (Sharieff, 2008).

Iron deficiency is particularly prevalent in early adolescence, mostly among girls due to an increase in red blood cell mass and the onset of menses (Soares *et al*., 2010). For example, a 14 year old girl would have an estimated iron requirement in excess of 30% of that required by her mother (Soares *et al*., 2010). More *et al*. (2013) noted that among adolescent girls aged 12 – 15 years living in India; those who were iron deficient had lower scores of mental ability, attention and concentration, recognition and verbal memory than girls who were not iron deficient. Iron deficiency aneamia, believed to be present in 20-80% of all pregnant women is exacerbated in pregnant adolescents as the fetus competes with the mother for nutrients (Soares *et al*., 2010).

It is known that up to 90% of total adult skeletal mass is reached by the age of 17 years (Mesias *et al.,* 2011). Given the role of calcium in bone mineralisation during adolescence, an inadequate intake may lead to optimum peak bone mass not being achieved, thus, increasing the likelihood of becoming stunted and developing osteoporosis in adulthood (Gandy, 2014; Mesias *et al*., 2011). Research indicates that adolescent calcium intake is often insufficient to meet the growth requirements of this stage (Mesias *et al*., 2011). In addition, the phosphoric acid content of fizzy drinks, which is commonly consumed by adolescents; may limit calcium uptake by preventing its absorption; which may eventually lead to bone loss (Mesias *et al*., 2011).

2.4 Factors affecting Nutritional Status

2.4.1 Socioeconomic Status

In comparison to other middle-income countries, South Africa has significantly higher rates of absolute poverty and income inequality within its population (Altman *et al*., 2009). This phenomenon, coupled with disease burdens further exacerbates food insecurity, as morbidity reduces productivity and contributes to lower household income and food purchasing power

(Kimani-Murage, 2013). For example, in KwaZulu-Natal (KZN), unemployment and income poverty are much higher than the national average; more than a third of KZN's population live below the US$2 (R23) a day poverty line and two-fifths of the workforce is unemployed (Thurlow *et al*., 2009). In addition, KZN has the highest incidence of HIV infection, a combination of which places the province at particular risk of food insecurity, in spite of its agricultural potential (Thurlow *et al*., 2009).

Socioeconomic status (SES) is possibly the most direct contributor to food insecurity. In circumstances of chronic poverty, the cost of food usually takes precedence over its nutritional value (Temple *et al*., 2010). This is especially applicable to poor households that rely solely on food purchasing power (the financial ability to purchase food at retail prices), such as the urban poor, the rural landless and subsistence small-scale farmers (Belachew *et al*., 2012). Nutrient-dense foods such as fruits, vegetables and whole grains may contribute to better health but they are generally considered to be more expensive than energy-dense, nutrient-poor foods (Temple and Steyn, 2011; Temple *et al*., 2010). Also, nutrient-poor foods are generally more accessible in low-income areas when compared to healthier options (Goh *et al*., 2009).

In Soweto, South Africa, semi-structured interviews conducted among 58 female adolescents with a mean age 18 years revealed that school-based food purchases were mainly determined by availability and price (Voorend *et al*., 2013). With regards to food purchases, low-income households have been noted to prioritize shelf-life and ease of preparation in addition to price (Nackers *et al*., 2013). This may as an extension lead to the consumption of more processed foods with less nutritional value. Nackers *et al*. (2013) observed a larger amount of less healthy foods in the kitchens of low and very low food-secure parents from low-income areas with limited food access. Food insecure parents were also shown to live in a more obesogenic environment compared to parents that were food secure (Nackers *et al*., 2013). Cross-

sectional data from 30,779 18 year old Columbians, showed that those from poor households were up to five times more likely to be underweight compared to those of a higher SES. Similarly, adolescents of a higher SES were between 1.3 to 2.8 times more likely to be overweight than those from poor backgrounds. The disparity in the prevalence of overweight was associated with the mother being overweight (Garcia *et al*., 2012). Food frequency data from 8,442 Mexican adolescents aged 12-19 years (4130 boys and 4312 girls), revealed that the energy and micronutrient intake for both genders were the lowest in participants of a low SES and from rural areas (Rodríguez-Ramírez *et al*., 2009). In Cameroon, among 248 urban adolescent boys and 333 adolescent girls aged 12 to 16 years, it was found that participants with a low and medium SES were more likely to be stunted or underweight compared to participants of a higher SES; while the prevalence of obesity was observed to be high across all socioeconomic levels (Dapi *et al*., 2009). In a cross-sectional study conducted among 425 Ethiopian adolescents, the prevalence of underweight was significantly associated with the number of daily meals, parental level of education, source of food, and number of cattle owned (Alemayehu *et al*., 2010).

Data collected from 25 female adolescents aged 14 to 16 years attending urban public schools in Cape Town, South Africa, found that eating habits such as skipping breakfast and consuming unhealthy tuck shop foods were largely associated with SES; as only one participant reported living in the city, while the others lived in surrounding townships, thus having to leave home early and travel long distances to reach school (Stupar *et al*., 2012). This meant that they often missed opportunities to eat breakfast and prepare a packed lunch. Research indicates that the nutritional status of adolescents is influenced by parental SES as well as level of education. Garcia *et al*. (2012) noted a positive correlation between mothers with a low level of education and a risk of stunting in Colombian adolescents, as mother's level of education was associated with 44% of stunting.

In South Africa, Letlape *et al*. (2010) found that among 485 adolescents with a mean age of 17 years, only 15.3% had parents that were both employed, while 32.6% of participants had both parents unemployed. Among the entire group of adolescents, 77% did not have what was considered to be an adequate knowledge on diet, nutrition and exercise.

2.4.2 Urbanisation

Urbanisation can often lead to a change from a traditional rural diet to an urban diet, which is often characterised by a higher consumption of animal-derived foods, refined flour, sugar and sodium (Dolman *et al*., 2013). In South Africa, urbanisation is linked to a decrease in maize consumption (carbohydrate-rich) and an increase in animal product consumption (saturated fat-rich) (Stupar *et al*., 2012). Dietary changes are even more prominent among urban adolescents, as they are more exposed to brand marketing and advertising campaigns that target urban areas (Williams, 2013; Scully *et al*., 2011). It is believed that adolescents, particularly 13 to 17 year olds, are specifically targeted by food and beverage marketers due to their purchasing influence, spending power and the fact that they will soon become adult consumers (Williams, 2013).

A systematic review of comparative studies conducted across Africa (West, East, South, Central and North Africa) on adults older than 17 years with a mean BMI $\geq$ 28 kgm $^{-2}$ highlighted the fact that that there was an increased prevalence of obesity in urban areas compared to rural areas, particularly among females (Adeboye *et al*., 2012). In Cameroon, it was observed that the diets of rural adolescents consisted of more traditional foods, while the diets of urban adolescents consisted of more junk foods (Dapi *et al*., 2005). Among the 52 adolescents aged 12 to 15 years surveyed, urban residents consumed a significantly larger amount of junk foods (defined as white bread, biscuits, chocolate, candies, chips, sweet beverages, cake and doughnuts), meat and milk products when compared to rural residents

(Dapi *et al*., 2005). In the Zambézia Province of Mozambique, a study conducted among 551 girls aged 14-19 years from urban and rural areas, found that whilst no regional differences was observed regarding the prevalence of stunting (17.8%), overweight (12.6%) was more prevalent in urban areas (Korkalo *et al*., 2014).

The prevalence of obesity amongst urban South African adolescents has been associated with smaller families, lower levels of physical activity, higher parental income, and higher availability of energy-dense foods; all of which have been attributed to urbanisation (Rossouw et al., 2012). Kruger *et al*. (2005) observed that overweight and obesity was most prevalent among adolescents living in urban areas of the North West Province, South Africa compared to rural areas or informal settlements. A higher prevalence of overweight/obesity was also observed in adolescents belonging to families with fewer than five members (10.5%) compared to larger families (5.4%).

An obesogenic environment has been described as a poor nutritional environment, and is associated with factors such as geographical proximity to fast food outlets, supermarkets, recreational facilities and transport (Wall *et al*., 2012). Urban areas in general contain more obesogenic environments than rural areas, which can place adolescents at an added risk of becoming obese (Wall *et al*., 2012). Obesogenic environments are becoming more pronounced in LMICs with the spread of globalisation, particularly in lower income areas (Schram *et al*., 2013). In addition, many adolescents already engage in obesogenic behaviour, including low fruit and vegetable consumption, high fizzy drink consumption, and high snack intake (Hardy *et al*., 2012).

In some instances, urbanisation can lead to positive dietary habits possibly due to a higher availability of nutritious foods and exposure to nutrition information. A Polish study conducted among 116 adolescents aged 15-17 years from a small district revealed that 50.9% of urban participants consumed fresh fruit and vegetables on a daily basis compared to 41.0%

of rural participants (Hoffmann *et al*., 2012). In addition, 56% of urban adolescents preferred meals with less salt, in contrast to more than half of the rural adolescents opting for meals containing more salt (Hoffmann *et al*., 2012).

2.4.3 Food Frequency

Compared to early childhood, adolescence is seen as the period where individuals may experiment with new foods for various reasons including weight watching, peer influence and/or personal ideologies (e.g. vegetarianism) (Gandy, 2014). During middle adolescence (ages 15-16 years) adolescents are believed to begin trying out new ideas and developing interests outside of the family home (Coovadia, 2009). Hence the shaping of dietary practices that can extend into adulthood may well be occurring at this stage. The Standard American Diet (SAD); believed to be one of the least healthy diets and linked to an array of NCDs is being exported to the world via globalisation (Grotto and Zied, 2010). Given the role of media influence on food consumption, and the growing independence from parental control over food choices in the home, adolescents may be most at risk of nutrition-related complications as a result of such a diet.

In a Polish study conducted on 1,100 adolescents aged 16 to 19 years, poor dietary habits such as consuming an insufficient amount of fruits, vegetables and fish, and overconsumption of sweet snacks and drinks were noted (Wojtyła-Buciora *et al*., 2013). A study involving 140 Iranian adolescent girls found significantly lower nutrient adequacy ratios and higher energy dense diets in girls that consumed the most fast foods. Such girls were also more likely to be classified as overweight or obese (Rouhani *et al*., 2012). A cross-sectional survey conducted in Tunisia among 1,019 adolescents aged 15 to 19 years found that only 38% of participants consumed what was considered to be a diet of satisfactory quality (Aounallah-Skhiri *et al*., 2011). A shift from a traditional to a modern diet, characterised by an increase in the

consumption of white bread, dairy products, sugars, and added fats, and a decrease in the consumption of oils, grains, legumes, fruits and vegetables, was also associated with both urbanisation and increased SES (Aounallah-Skhiri *et al*., 2011). Not all adolescents display a high consumption frequency of unhealthy foods. A study conducted in Mauritius among 384 high school students aged 12 to 19 years showed that 84% engaged in snacking between meals, with fruit and yoghurt being the most popular snacks (Ranjana *et al*., 2013). This can be attributed to the decision of the Mauritian government to ban the sale of unhealthy snacks in school canteens. In addition, 76% of adolescents reported that they drank water and 52% drank fruit juice as opposed to other beverages such as fizzy drinks (Ranjana *et al*., 2013).

The South African Food-Based Dietary Guidelines (FBDGs) were drafted in 2000, and officially adopted as national dietary guidelines in 2003 (Love *et al*., 2008). Its aim was to assist the population in achieving a healthy and balanced diet, and to address nutrition-related public health problems such as undernutrition and obesity (Vorster *et al*., 2013). In 2012, the FBDGs were updated to include the following (Vorster *et al*., 2013):

1. Enjoy a variety of foods
2. Be active
3. Drink lots of safe, clean water
4. Make starchy foods part of most meals
5. Eat plenty of fruits and vegetables every day
6. Eat dry beans, peas, lentils and soya regularly
7. Chicken, fish, lean meat, or eggs can be eaten daily
8. Have milk, maas or yoghurt every day
9. Eat fats sparingly**;** choose vegetable oils rather than hard fats
10. Use salt sparingly and foods high in salt sparingly
11. Use sugar and food and drinks high in sugar sparingly

The guidelines however, are not strictly adhered to, particularly by adolescents. According to the South African National Health and Nutrition Examination Survey (SANHANES-1), it was reported that only 4.6% of the adolescent population consumed the recommended guidelines for fruits and vegetables (Shisana *et al*., 2013).

2.4.4 Household Food Insecurity

Household food insecurity has been associated with both obesity and undernutrition. A study investigating the nutritional status of 670 Tanzanian adolescents using BMI revealed an underweight prevalence of 21% that was inversely associated with household dietary diversity scores; which was largely associated with food insecurity (Cordeiro *et al*., 2012). Among adolescents, food insecurity can lead to inadequate nutrient intake and stress, which turn can affect development and sexual maturation (Belachew *et al*., 2011a). In Southwest Ethiopia, a study conducted among 900 girls with a median age of 15 years showed that food insecure girls were more likely to have menarche delayed by one year compared to food secure girls. In addition, stunted girls were also likely to have menarche one year later when compared to girls that were not stunted (Belachew *et al*., 2011a). Data from another study in Southwest Ethiopia involving 2009 adolescents aged 13 to 17 years revealed that 33% more food insecure learners were absent from school compared to those that were food secure and that overall household food insecurity was positively associated with lower educational attainment (Belachew *et al*., 2011b). According to the South African National Food Consumption Survey (NFCS) conducted in 2005, only 80% of the population was considered food insecure (Labadarios *et al*., 2008). Apart from stunting and underweight, household food insecurity has also been associated with overweight and obesity amongst adolescents (Kac *et al*., 2012). In Brazil, a study conducted among 1529 female adolescents aged 15-19 years

showed an increased prevalence of overweight and obesity among girls living in severely food-insecure households when compared to girls that were food secure (Kac *et al*., 2012).

2.4.5 Nutrition Knowledge

It is important to take cognisance of the level of nutrition knowledge of adolescents in LMICs, as well as their perception of food and how diet relates to health; however little data is available on this subject. Some adolescents do in fact possess adequate nutrition knowledge and apply it to improve their health and/or lose weight, while others do not (Utter *et al*., 2007). Some adolescents may have a level of nutrition knowledge, although it may not always be reflected in their dietary behaviour. For example, Ranjana *et al*. (2013) demonstrated in a Mauritian study conducted among 384 learners aged 12-19 years that despite 78.9% confirming that breakfast was the most important meal of the day, 68% admitted to skipping breakfast, with six percent reporting to always skipping breakfast. Improving nutritional status among adolescents may thus prove to be more complex than simply providing nutrition information. It is therefore clear that alternative efforts to support adolescents in improving their eating habits and therefore nutritional status should also be explored.

In a survey conducted among 1,050 Korean adolescents aged 14-19 years, it was shown that while many respondents perceived fast food as unhealthy and less nutritious, less was known about its impact on their health and nutritional status; as 43.1% had little or no knowledge about the nutritional content of fast food. The majority of respondents reported to consume fast food because it was “fast, easily accessible and tasty” (Yoon *et al*., 2008). Another aspect of interest is the source of nutrition and dietary information adolescents make use of. In the same study it was reported that 31.0% relied on themselves for dietary information, 20.5% relied on their parents and 19.9% relied on friends. The most popular medium for health and

nutrition information was television (66.8%), followed by the internet (36.7%) and magazines (29.7%) (Yoon *et al*., 2008).

A nutrition knowledge questionnaire (NKQ) developed by Whati et al. (2005) targeting 13 to 19 year old South African adolescents was based on measuring knowledge regarding the South African FBDGs (Vorster *et al*., 2013). It was used to determine the nutrition knowledge of 485 adolescents (43.3% males and 56.7% females) aged 15 to 18 years attending a high school in Pretoria, South Africa. Findings indicated that 77% of participants scored below average on questions related to diet, nutrition and physical activity (Letlape *et al*., 2010).

Another NKQ developed by the Medical Research Council of South Africa was used to assess the nutrition knowledge of 98 adolescents aged 14 to 18 years attending five schools in rural Cofimvaba, South Africa. In this study, socio-demographic data indicated that 19.3% of the participants' caregivers had no education; 46.8% only had a primary school education; and 3.7% had a tertiary education. In addition, 82.8% of caregivers were unemployed for more than five years. In spite of this, the overall score for the multiple-choice section of the NKQ was relatively high at 72.9%. However, none of the participants were able to identify fizzy drinks as a causative factor of tooth decay (Oldewage-Theron et al., 2014).

2.4.6 Gender

The gender disparity in the prevalence of overweight and obesity among adolescents has been attributed to factors such as differences in energy requirements, timing of sexual maturation, levels of physical activity, and cultural beliefs (Rossouw *et al*., 2012). As a result, nutrient requirements are usually gender-specific. Since boys undergo greater height, weight and lean body mass increases than girls, they have higher energy requirements (Gandy 2014; WHO, 2005). Boys also require more protein per unit of height during the ages of 15-18 years, which corresponds with their peak height velocity (Gandy, 2014; WHO, 2005). Girls require

more protein per unit of height during the age range of 11-14, as this period usually represents the onset of menstruation, which is also accompanied by an expansion in blood volume and muscle mass (Mesias *et al*., 2013; Mesias *et al*., 2011; WHO, 2005). In addition, increases in iron are required in both boys and girls during periods of peak growth (Mesias *et al*., 2013).

Research generated from LMICs highlighted significant gender differences among adolescents with regards to dietary practices and the prevalence of underweight and overweight/obese (Kimani-Murage *et al*., 2011; Banerjee *et al*., (2011; Barriguete-Meléndez *et al*., 2009; Reddy *et al*., 2009; Dapi *et al*., 2009; Jinabhai *et al*., 2007).

The Brief Questionnaire for Risky Eating Behaviours (Barriguete-Meléndez *et al*., 2009) was administered to 25,166 Mexican adolescents aged 10-19 years, of which 50.3% were female and 49.7% were male. For all eating disorders assessed, the highest prevalence was found in females older than 13 years and males older than 15 years. This may be indicative that food perceptions may develop at an earlier age in girls than in boys (Barriguete-Meléndez *et al*., 2009). In an Ethiopian study, results generated after surveying 425 adolescents revealed a higher prevalence of underweight in males (29.8%) compared to females (24.6%), while in contrast, a higher prevalence of overweight was noted amongst females (4.9%) compared to males (3.8%) (Alemayehu *et al*., 2010). Similar results were observed in an Indian study, where Banerjee *et al*. (2011) reported that among 1,015 rural adolescents aged 10 to 19 years (565 boys; 450 girls), a significantly higher percentage of males were underweight (37.8% males vs. 27.5% females) and severely underweight (10.4% males versus. 4.6% females). In Cameroon, Dapi *et al*. (2009) found that when compared to males, female adolescents were significantly less likely to be stunted (6% vs. 15%) and underweight (2% vs. 5%), and more likely to be overweight with an odds ratio of 4.3 to 1.

In South Africa, a sample of 3,273 15 year olds permanently residing in a densely populated urban area, the prevalence of overweight and obesity among females was 25%, while 8% of males were reported to be overweight (Ginsburg *et al*., 2013).

Among 1,848 adolescents aged 10 to 20 years from the Mpumalanga Province in rural South Africa, the combined overweight and obesity prevalence was higher among females than males (15% vs. 4%), as was abdominal obesity (15% vs. 2%), in which the odds increased by 10% for each unit increase in age (Kimani-Murage *et al*., 2011). Another South African study involving 9,224 students aged 13 to 19 years that hailed from all nine provinces, found a significantly higher incidences of underweight among males (15.6%) compared to females (3.9%). The same study revealed an overweight and obesity prevalence of approximately 30% among females compared to 9.1% among males (Reddy *et al*., 2009). According to Jinabhai *et al*. (2007), a study conducted among 5,322 Black South African adolescents aged 13 to 18 years found that males had a significantly higher incidence of undernutrition compared to females (18.4% vs. 2.6%), as well as higher incidences of stunting (21.9% vs. 9.4%). Females on the other hand, had a significantly higher prevalence of overweight compared to males (20.9% vs. 4.2%). Among 1,257 adolescents aged 10–15 years residing in the Northwest Province of South Africa, the prevalence of overweight and obesity was twice as high among post-menarche females, indicating that obesity risk among females increased with age (Kruger *et al*., 2005).

The association between gender and obesity in African populations is often believed to be related to cultural associations (Puoane *et al*., 2010). Body size and body image perceptions were assessed among 240 Black adolescent females aged 10 to 18 years; and it was found that two-thirds of participants perceived a larger body size (“fatness”) to be a sign of happiness and wealth, including dominant reasons such as being able to “engage in sport activities that needed strength” and to “make one look respectable”. Three quarters of

participants perceived a smaller body size ("thinness") with ill health particularly HIV/AIDS and TB. However, a smaller body size was also associated with a reduced susceptibility to NCDs such as diabetes and hypertension (Puoane *et al*., 2010).

It has been suggested that nutrition interventions targeting adolescent females should be prioritized, as young women would eventually be in charge of household food preparation, and thus educating the family about nutrition (Letlape *et al*., 2010). Letlape *et al*., (2010) reported that 47.1% of a total of 485 adolescents aged 15 to 18 years had their meals prepared by their mother, with only approximately one percent reporting having their food prepared by their father.

2.5 Conclusion

The nutritional status of adolescents is influenced by several factors. Within the LMIC context, it appears that SES (including household size, parental level of education and employment status), urbanisation and gender are determinants of underweight, stunting and overweight/obesity. Research suggests that a key determining factor regarding the impact of SES on adolescent nutrition appears to be parental education; as poor dietary habits have been associated with both high and low SES. Urbanisation in LMICs can expose adolescents to obesogenic environments, placing them at risk of developing obesity and later NCDs. Current evidence highlights the overwhelming gender disparity regarding adolescent nutrition status; with higher overweight/obesity prevalence among girls and higher stunting and underweight prevalence among boys. The adolescent stage of the human lifespan presents a promising opportunity to introduce dietary intervention strategies such as nutrition education, as independent dietary habits are usually formed during this period. Effective dietary interventions coupled by nutrition-related education and public health initiatives that are

inclusive of these factors may play a role in reducing the impact of nutritional complications and disease burden.

CHAPTER 3

ADOLESCENT NUTRITION KNOWLEDGE AND SOCIOECONOMIC STATUS AT AN URBAN VERSUS A PERI-URBAN SCHOOL IN HILTON, SOUTH AFRICA

Abstract

Objective: The aim of this study was to conduct a comparative analysis of socioeconomic status (SES) and nutrition knowledge between adolescents attending an urban versus a peri-urban school in KwaZulu Natal, South Africa.

Design: Cross-sectional descriptive survey

Setting: Urban and peri-urban high schools in Hilton, KwaZulu Natal

Subjects: 98 grade 9-11 learners from an urban high school and 111 grade 9-11 learners from a peri-urban high school

Results: Overall, the urban school had a higher mean NKS than the peri-urban school (59.8 ± 15.7 % versus 55.7 ± 15.7 % respectively). Significantly higher nutrition knowledge scores (NKS) were observed in adolescents with educated mothers and full-time employed fathers ($p<0.05$), which was greater in the urban school than the peri-urban school. In the urban school, Black students had a significantly higher mean NKS than White students (65.0 ± 7.7 % versus 59.2 ± 18.8 % respectively; $p<0.05$). No significant differences in NKS were found between age and gender in both schools.

Conclusion: An association exists between nutrition knowledge in adolescents and SES indicators (education and employment), but not with age, gender and ethnicity. Thus, adolescents from poorer backgrounds may benefit from nutrition education programs within the school setting.

Introduction

The education system in South Africa has been restructured to redress gross inequalities that existed during the apartheid era (Mouton *et al*., 2012). As a result, individuals born since the 1980s have increased access to quality education, and improved prospects for employment compared to individuals born a decade earlier (Branson *et al*., 2013). For example, the number of Black South Africans attending university increased by 80% during the 1990s (Jansen, 2004). However, at secondary school level, despite improvements over the years including increased enrolment, the quality of education delivered remains below par and grossly imbalanced along socioeconomic and ethnic lines (Spaull, 2013). Compared to other middle-income countries and even its own national curriculum, South African secondary schools notably underperform with regards to academic achievement (Van der Berg, 2009).

The socioeconomic transition in South Africa was accompanied by a nutrition transition, which saw individual diets changing from traditional to more "globalised" foods (Stupar *et al*., 2012). Dietary habits including higher intakes of sugar, salt and saturated fats and lower intakes of fruits, vegetables and water, are key risk factors leading to the development of obesity and non-communicable diseases (NCDs) (Stupar *et al*., 2012; Bhattarai, 2012). With a growing incidence of NCDs alongside existing communicable disease epidemics, South Africa is faced with a double-burden of disease (Bygbjerg, 2012; Kahn, 2011).

Overweight and obese individuals are believed to be increasingly susceptible to NCDs including diabetes, cardiovascular diseases (CVDs) and various cancers (Bhattarai, 2012). Mortality and morbidity from NCDs have long surpassed that of communicable diseases in many low and middle-income countries (LMICs) (Lopez *et al*., 2006). Yet the threat of communicable diseases has not been eliminated as undernutrition, a significant risk factor, remains prevalent (Krawinkel, 2012; Kahn, 2011). Food insecurity leads to poor diet quality, micronutrient deficiencies and energy loss (Black *et al*., 2013). This can lead to a poor

immune response, which in turn increases infection susceptibility (Krawinkel, 2012; Schaible and Kaufmann, 2007).

Independent dietary habits are believed to be formed during adolescence (Belachew *et al*., 2012). It is estimated that over 33% of disease burden and nearly 60% of premature deaths in adults are related to lifestyle practices adopted during adolescence; among which includes poor dietary habits (Lule and Rosen, 2006). There has been limited research on adolescent nutrition knowledge in LMICs, particularly in relation to socioeconomic status (SES). The objective of this study was to comparatively assess the nutrition knowledge of adolescents attending an urban and a peri-urban school, and investigate its relationship with SES, gender and ethnicity.

Methods

Study Population

For this cross-sectional descriptive study, the study population consisted of grade 9-11 adolescents from two secondary schools participating in an outreach programme; one being a private urban school, and the other a peri-urban school, both situated in Hilton. Hilton is a small town situation just above Pietermaritzburg in KwaZulu-Natal, South Africa,

The private urban school runs an outreach programme, where formal training for principals and teachers is provided to schools from peri-urban communities in Hilton. Also, learners from the private urban school provide academic support to students from the peri-urban school (Grace College Outreach Programme, 2013).

Secondary schools in South Africa are classified according to national and provincial quintiles ranging from one to five. Classification is based on socioeconomic information from the community or area where the school is located; including parental income,

education levels, and employment status. Quintile 1 (Q1) schools represent the 20% of schools situated in areas with the lowest socioeconomic status (SES), while quintile 5 (Q5) schools represent the 20% of schools present in areas of high SES (Department of Education (DoE), 2004). The private urban school, classified as a Q5 school, consisting of a diverse student population (Black, Indian, White and Coloured), whereas the peri-urban school is classified as a Q1 school and consists of predominantly Black students. Participant age, varied between 14 -17 years in the private urban school and between 14 and 21 years in the peri-urban school.

Data Collection

Two hundred and nine students (209: 98 from the Q5 and 111 from the Q1 school) volunteered to participate in the study. Data was collected between June and August 2013. Prior to data collection, volunteers were briefed on the study objectives in English and IsiZulu, after which they signed an informed consent form. Grades 8 and 12 were excluded from the study, as grade 8 students were considered too young to participate, and grade 12 students were in the process of preparing for their matriculation exams.

For the purpose of the study, it was assumed that all participants were responding sincerely and truthfully.

Two closed-ended questionnaires were given out for participants to complete; a nutrition knowledge questionnaire (NKQ), and a socio-demographic questionnaire (SDQ).

The NKQ was developed specifically for the assessment of nutrition knowledge in adolescents aged 13 to 19 years old (Whati *et al*., 2005). The development process involved identification of nutritional concepts in accordance with the South African national teaching curriculum and the South African Food-Based Dietary Guidelines (Vorster *et al*., 2013; Whati *et al*., 2005). The level of nutrition knowledge of participants was categorised using a

Stanine Performance (SP) rating scale as follows: 1= <34% (very poor); 2-4 = 34-51% (fair); 5 = 52-57% (good); 6-9 = 58-75% (very good); 9 = 76+% (excellent) (Letlape et al. 2010).

The SDQ was developed for the purpose of this study and collected information on parental education, employment status and general household living situation.

Participants from the peri-urban school were given the option of questionnaires in English or IsiZulu. The questionnaires were piloted to five random grade 10 students at the urban and peri-urban school to ensure simplicity and straightforwardness. Questionnaire data was collected by bilingual and trained fieldworkers that assisted participants when necessary.

Data Analysis

Results were analysed using SPSS® 19 (SPSS, Chicago, Illinois, USA). Pearson correlation analysis and chi-square tests were performed. Significance was measured at the 0.05 level (two-tailed).

Ethics

Approval for this study was given by the Ethics Sub-Committee (Humanities and Social Sciences) of the University of KwaZulu-Natal (UKZN) (protocol reference number: HSS/0271/013D) and was conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

Results

The socio-demographic characteristics of the study population are listed in Table 1.

Table 1: Characteristics of the study population

	Urban (Q5) [N =98]	% of group	Peri-Urban (Q1) [N=111]	% of group
Black	30	30.6	108	97.3
White	56	57.1	0	0
Coloured	7	7.1	3	2.7
Indian	5	5.1	0	0
Male	56	57.1	65	58.6
Female	42	42.9	46	41.4
Age range (y)	14.33 years -17.5 years		14.16 years – 21.83 years	

Table 2: Parental Education of Urban versus Peri-Urban School

Mother's Education	Urban [N = 97]	Peri-Urban [N=97]	Grade 10 Peri-Urban [N = 41]	Grade 11 Peri-Urban [N = 30]
Primary[%]	1 [1.0]	13 [13.4]	5 [12.2]	4 [13.3]
Secondary[%]	24 [24.7]	70[74.2]	29 [70.7]	25 [83.3]
Tertiary[%]	62[63.9]	14 [14.4]	7 [17.1]	1 [3.3]
Father's Education	Urban [N=32]	Peri-urban [N=25]	Grade 10 Peri-urban [N=38]	Grade 11 Peri-urban [N=27]
Primary[%]	0 [0]	11 [11.3]	6 [15.8]	2 [7.4]
Secondary[%]	20 [20.6]	51 [52.6]	17 [44.7]	23 [85.2]
Tertiary[%]	70[74.2]	28 [28.9]	15 [39.5]	2 [7.4]

Results from the SDQ highlighted a disparity in parental education and employment between the urban and peri-urban schools (Tables 2 and 3).

The number of mothers with a tertiary level education at the urban school was more than four times higher than in the peri-urban school (63.9% versus 14.4%). A similar trend was observed in father's tertiary education, albeit a smaller gap (See Table 2). In all grades only

one mother in the urban school and none of the fathers had a primary school education, whereas 13 mothers and 11 fathers had a primary education in the peri-urban school. Four students in the peri-urban school reported having both parents with a primary school education. Mother's education in the group as a whole was positively correlated with nutrition knowledge scores (NKS) ($p<0.05$), however father's education was not.

Table 3: Parental Employment of Urban versus Peri-Urban School

Mother's Employment	Urban [N=94]	Peri-Urban [N=91]
Full-time[%]	65 [69.1]	49 [53.8]
Part-time[%]	18 [19.1]	18 [19.8]
Unemployed[%]	8 [8.5]	13 [14.3]
Disabled[%]	0 [0]	6 [6.6]
Retired [%]	3 [3.2]	5 [5.5]
Father's Employment	Urban [n= 87]	Peri-Urban [n=82]
Full-time[%]	76 [87.4]	50 [61.0]
Part-time[%]	6 [6.9]	11 [13.4]
Unemployed[%]	4 [4.6]	10 [12.2]
Disabled[%]	0 [0]	4 [4.9]
Retired [%]	1 [1.1]	7[8.5]

More mothers were employed full-time in the urban school [n=65/94; 69.1%] compared to the peri-urban school [n=49/91; 53.8%] (Table 3). The same trend was observed with fathers in full-time employment. A positive correlation was found between fathers in full-time employment and NKS ($p<0.05$) but not with mothers in full-time employment.

The SDQ did not collect data on income levels.

Table 4: Nutrition Knowledge Scores (NKS) according to the SP-rating Scale

Stanine Performance	Score [%]	Urban [N=98]	Peri-Urban [N=110]
1	[<34] V. Poor	0[0]	9 [8.2]
2-4	[34-51] Fair	6 [6.1]	65 [59.1]
5	[52-57] Good	8 [8.2]	19 [17.3]
6-9	[58-75]V. Good	51 [52.0]	14 [12.7]
9	[76+] Excellent	33 [33.7]	3 [2.7]

A total of 208 students completed the nutrition knowledge questionnaire. Results indicated higher NKS in the urban school compared to the peri-urban school (Table 4). Overall, the urban school had a mean NKS of 59.8 $\pm$ 15.7 % and the peri-urban school a mean NKS of 55.7 $\pm$ 15.7 % ($p<0.05$). A total of 51 urban school participants received a SP rating of 6-9, which is indicative of a "Very Good" score between 58-75% and 33 had a rating of 9 ("Excellent" – 76+%); whereas 70% of the peri-urban school participants had a SP rating of 2-4 ("Fair" – 34-51%).

In the peri-urban school, 62.2% had a rating of 2-4, while 11.1% had a rating of 1 ("very poor" - <34%). The mean NKS in the peri-urban school was 64.9 $\pm$ 13.3% (Table 4).

Irrespective of grade, no student from the urban school scored within the lowest SP rating of 1, and only three students from the peri-urban school had the highest SP rating of 9 (Table 4).

Age

A considerable age disparity existed between both schools. The oldest grade nine student from the urban school was 16 years whereas the oldest student from the peri-urban school was 18 years. The disparity increased in the higher grades as the oldest grade 10 and 11 students from the peri-urban school were 21 years compared to 17 years in the urban school. Also, in grades 9, 10 and 11 there was a five, six, and five year gap respectively between the

oldest and youngest student in the peri-urban school. Age however, was not associated with a higher NKS.

Gender

Overall, a higher mean NKS was found in the urban school versus the peri-urban school for boys and girls. Whilst no significant differences in mean NKS were observed between genders in both schools, mean NKS was higher in boys than girls at the urban school, and higher in girls than boys at the peri-urban school. Across all grades, urban school boys had a mean NKS of 61.5 $\pm$ 16.8 %, compared to 57.7 $\pm$ 14.0 % in urban school girls. In contrast peri-urban school boys had a lower mean NKS of 55.6 $\pm$ 16.2 % compared to peri-urban school girls with a mean NKS of 56.1 $\pm$ 15.2 %.

Discussion

Parental education and employment are indicators of SES, and this study highlighted its association with the nutrition knowledge of adolescents. It is largely perceived that nutrition knowledge and dietary habits in general are poor among adolescents; however SES appears to also contribute to a lack of nutrition knowledge. In this study, lower nutrition knowledge was observed among adolescents from the peri-urban school; who were characterised by lower parental education and employment, which is indicative of a low SES.

An NKQ developed by the Medical Research Council of South Africa was used to assess the nutrition knowledge of 98 adolescents aged 14 to 18 years attending five schools in rural Cofimvaba, South Africa. In this study, socio-demographic data indicated that 19.3% of the participants' caregivers had no education; 46.8% only had a primary school education; and 3.7% had a tertiary education. In addition, 82.8% of caregivers were unemployed for more than five years. Despite this, the overall score for the multiple-choice section of the NKQ was relatively high at 72.9% (Oldewage-Theron et al., 2014).

In another study conducted at a South African high school in Pretoria, it was shown that 77% of adolescents did not have what was perceived to be adequate knowledge on diet and nutrition and 23% had only satisfactory knowledge (Letlape *et al*., 2010). Although this study did not directly investigate SES, it was reported that only 15.3% of learners had both parents employed, whilst 32.6% had both parents unemployed (Letlape *et al*., 2010).

Research conducted in six South American countries observed higher obesity knowledge scores among adolescents with a higher SES, despite overall obesity knowledge being low (McArthur *et al*., 2001).

It was indicated that students with mothers educated up to tertiary level and employed full-time were more likely to have a higher NKS. This is reflected in the higher NKS observed at the urban school and the positive correlation between mothers with tertiary education and in full-time employment. The same correlation was not observed with father's education and employment, which may be related to the idea that mothers are usually in control of household food purchasing and preparation, and thus would more likely be the parent to teach children about dietary practices. It was reported that 47.8% of the adolescent students had family meals prepared by their mother compared to approximately one percent prepared by their father (Letlape *et al*., 2010).

Students from the peri-urban school were considerably older than their urban school counterparts in the same grade. This age difference however, was not reflected in a higher NKS, as peri-urban school students performed poorly overall compared to the urban school.

Although no significant differences in NKS were noted between genders, it was interesting to observe that boys performed better than girls in the urban school but not in the peri-urban school, which saw girls outperform boys, albeit slightly. This may be indicative of differing gender roles that may exist in low income and/or traditional families, where girls may be

required to participate more in household duties, including food preparation. It was again showed that male students along with their fathers and elder brothers were seldom involved in household food preparation (Letlape *et al*., 2010).

The urban school was ethnically diverse, whereas the peri-urban school consisted primarily of Black students. It was noted that Black students in the urban school scored significantly higher than White students, and the score remained higher when other non-white students were included. This thus indicates that the disparity in NKS between the urban and peri-urban school is related to SES as opposed to ethnicity. To date there has been very little research into the ethnic differences in nutrition knowledge among adolescents. It has been reported that SES outweighed nutrition- and health-related psychosocial factors such as nutrition knowledge and behaviour in explaining the ethnic differences in diet, exercise, and weight status among adults (Wang and Chen, 2011). However, the authors conceded that SES did not explain in entirety the ethnic disparities within the population (Wang and Chen, 2011). In this study, participants from the urban school were stratified according to ethnicity, and it was observed that Black and non-white students had significantly higher NKS than White students, a result that could not be simply attributed to differences in SES.

Conclusion

Adolescents from a low socioeconomic background (classified by low parental education and employment), appear to have lower levels of nutrition knowledge and may benefit from nutrition education programs within the school setting. Results of this study illustrates the current socioeconomic disparities among schools and students in South Africa, despite being generated from small non-probability samples Additional studies involving larger sample sizes are warranted to gain further insight into nutrition knowledge among adolescents in South Africa and its impact on overall diet, health and disease risk.

Acknowledgments: The principals of the two consecutive schools where data was collected; fieldworkers who assisted with data collection; the participants from both schools

Conflict of Interest: None

Authorship

Frederick Veldman was the final editor and contributed to the statistical analysis of data presented in the results section. Susanna Kassier drafted the methodology section and was the first editor. Keiron Audain was the main author and contributed to the introduction as well as the data analysis and interpretation in the discussion and conclusion.

CHAPTER 4
A COMPARATIVE ANALYSIS OF NUTRITION STATUS IN ADOLESCENTS FROM AN URBAN VERSUS A PERI-URBAN SCHOOL, KWAZULU-NATAL, SOUTH AFRICA

Abstract

Objective: A comparative analysis of the anthropometric status of adolescents from two secondary schools in the KwaZulu Natal province of South Africa that differ according to the SES of the learners.

Design: Cross-sectional descriptive survey

Setting: An urban and peri-urban high school in Hilton, KwaZulu Natal, South Africa,

Subjects: 111 grade 9-11 learners from a peri-urban school and 98 grade 9-11 learners from an urban school volunteered to participate.

Outcome measures: Anthropometric measurements including weight, height and MUAC were measured and body mass index (BMI) was calculated.

Results: A higher prevalence of overweight (> +1SD - 25kg m^{-2}) and obesity (>+2SD - BMI 30 kg m^{-2}) among urban school boys compared to peri-urban school boys ($p<0.01$) and among peri-urban school girls compared to urban school girls ($p<0.01$) was observed across all grades. A higher prevalence of moderate stunting (<-2SD and >-3SD) was observed among peri-urban school boys ($p<0.01$) compared to their urban school counterparts.

Conclusion: Albeit a small sample size, results from this study indicates that SES and gender may play a determinant role in overweight, obesity and stunting prevalence, as boys in urban areas and girls in peri-urban areas may be at a higher risk of overweight/obesity, whereas peri-urban boys may be at a higher risk of stunting. It can also be concluded that a double

burden of stunting and overweight/obesity may exist among adolescents from peri-urban areas, who were considered to be of low SES.

Introduction

An increasing number of low-to-middle income countries (LMICs) are faced with a double-burden of malnutrition; which is characterised by a growing incidence of overnutrition (overweight/obesity), and an existing incidence of undernutrition (underweight/stunting) (Tathiah *et al*., 2013; Delisle, 2008). Middle-income countries in particular have undergone rapid nutrition transitions (Shetty, 2013); a phenomenon largely associated with globalisation. Hence countries such as South Africa have experienced a shift in dietary patterns from traditional to more "globalised" foods rich in sugar, sodium, and saturated fat from animal sources (Lock *et al*., 2010). A South African study utilising data from the Birth-to-Twenty cohort revealed that fast food was consumed between five and seven times a week by 30% of adolescent participants, while 20% consumed fast food at least twice to four times a week (Steyn *et al*., 2011). An increase in the consumption of such energy dense but micronutrient-poor foods may contribute to chronic nutritional problems such as stunting and overweight/obesity.

Stunting is defined as a low height-for-age (Uauy *et al*., 2014). Although largely associated with being underweight, stunting can occur independently of weight-for-age, making it possible for an individual to be both stunted and overweight or obese (Tathiah *et al*., 2013; Uauy et al., 2014). Stunting is characterised by an inadequate diet over a long-term period, and among adolescent learners can lead to poor academic performance and a reduced physical capacity for work (Tathiah *et al*., 2013; Leal *et al*., 2012). In addition, the micronutrient deficiencies that leads to stunting comes with the increased risk of developing communicable diseases, as undernutrition and infection share a synergistic and cyclic

relationship (Bhutta and Salam, 2013). Research conducted in Colombia observed a 44% increase in respiratory infections among stunted school children compared to those who were not stunted (Dekker *et al*., 2010).

Overweight and obesity are defined as a high weight-for-height or BMI-for-age (Uauy *et al*., 2014). In contrast to stunting, obesity has mainly been associated with affluence (Kahn, 2011). However, it has become more widely prevalent in low-income areas due to the increased availability and affordability of globalised foods (Stupar *et al*., 2012; Temple and Steyn, 2011). Obesity is linked to a rise in non-communicable diseases (NCDs), including type 2 diabetes, hypertension, various cancers, and cardiovascular diseases (CVDs), which is the leading cause of death worldwide (Lock *et al*., 2010; Amuna and Zotor, 2008; Kruger *et al*., 2005). Future predictions attribute approximately 77% of global deaths to NCDs by 2030, the majority of which will occur in LMICs (Boutayeb and Boutayeb, 2005). Using disability-adjusted life years (DALYS), the World Health Organisation (WHO) estimated that in 2008, there were approximately 92,400 male and 98,100 female NCD-related mortalities in South Africa (WHO, 2010).

Gender has a unique role in nutrition status and disease susceptibility, owing to the specific nutritional requirements needed during pregnancy and lactation (Delisle, 2008). As a result, malnutrition places females at risk of pregnancy complications (Popkin *et al*., 2012). This is of particular concern during adolescence, as a high nutritional demand is already warranted to facilitate the rapid growth rate due to pubertal development (Belachew *et al*., 2012). Hence nutrient deficiencies during this period can result in delayed sexual maturation and poor overall growth (Belachew *et al*., 2012). Adolescent fertility is three times higher in LMICs compared to high-income countries (Black *et al*., 2013). Despite having a lower rate compared to other middle-income countries, teenage pregnancy in South Africa is believed to be around 30% in 15-19 year olds (Willan, 2013).

Research has highlighted the co-existence of obesity and stunting within the same population, as individuals even in the same household can be reported as stunted and/or obese (Kahn, 2011; Kimani-Murage *et al*., 2010). In rural South Africa, a study showed an increased risk of overweight/obesity among girls and an increased risk of stunting among boys, both of adolescent age (Kimani-Murage, 2013). In adolescence, such a combination can exacerbate the risk of developing NCDs in later years (Kimani-Murage, 2013; Mayosi *et al*., 2009; Baker *et al*., 2007).

To date, little insight has been provided on the nutritional status of adolescents from different socioeconomic backgrounds. The objective of this study was to conduct a comparative assessment of the anthropometric status of adolescents from an urban versus a peri-urban school in the KwaZulu-Natal province

Methods

Study Population

For this cross-sectional descriptive study, the study population consisted of grade 9-11 adolescents from two secondary schools participating in an outreach programme; one being a private urban school, and the other a peri-urban school, both situated in Hilton. Hilton is a small town situated on the outskirts of Pietermaritzburg in KwaZulu-Natal, South Africa. The private urban school runs an outreach programme, for which formal training for principals and teachers is provided to schools from peri-urban communities within the Hilton area. Also, learners from the private urban school provide academic support to learners from the peri-urban school (Grace College Outreach Programme, 2013).

Secondary schools in South Africa are classified according to national and provincial quintiles ranging from 1 to 5 (Department of Education (DoE), 2004). Classification is based on socioeconomic information from the community or area where the school is located;

including parental income, education levels, and employment status (Murtin, 2013). Quintile 1 (Q1) schools represent the 20% of schools situated in areas with the lowest socioeconomic status (SES), while quintile 5 (Q5) schools represent the 20% of schools present in areas of high SES. The private urban school, classified as a Q5 school, consisting of a diverse learner population (Black, Indian, White and Coloured), whereas the peri-urban school is classified as a Q1 school and consists of predominantly Black learners. The age of those participants that attended the private urban school, varied between 14 -17 years, whereas those from the peri-urban school were aged between 14 and 21 years.

Data Collection

A total of 209 learners (98 from the Q5 and 111 from the Q1 school) volunteered to participate in the study. Data was collected between June and August 2013. Prior to data collection, volunteers were briefed on the study objectives in English and IsiZulu, after which they signed an informed consent form. Grades 8 and 12 were excluded from the study, as grade 8 learners were considered too young to participate, whereas grade 12 learners were in the process of preparing for their matriculation exams.

The anthropometric data collected in this study included height (m), weight (kg) and mid-upper arm circumference (MUAC) (cm). A stadiometer was used to measure height whereas a Seca 813 heavy duty floor scale with a platform to accommodate large feet was used to measure weight. Body mass index (BMI) was calculated from the height and weight measurements according to the formula weight (kg)/height^2 (m^2). A non-elastic Seca tape with a slide-in mechanism to facilitate accurate circumference measurement was used to measure MUAC. All anthropometric data was collected by fieldworkers who were adequately trained by a level III anthropometrist in accordance with the International Society for the Advancement of Kinanthropometry (ISAK) standards. Each measurement was repeated three

times and the average of the two closest measurements were calculated to ensure accuracy. BMI-for-age and height-for-age were calculated using WHO z-scores, and used to determine overweight, obesity and stunting. Overweight was defined as having a z-score greater than +1SD (25kg m $^{-2}$ at 19 yrs), and obesity as having a z-score greater than+2SD (BMI 30 kg m $^{-2}$at 19 yrs). Moderate stunting was defined as having a z-score between -2SD and -3SD, whereas severe stunting was defined as having a z-score greater than-3SD (UNICEF, 2013).

Data Analysis

Results were analysed using SPSS® 19 (SPSS, Chicago, Illinois, USA). Descriptive statistics, Pearson correlation coefficients and chi-square tests were performed. Significance was measured at the 0.05 level (two-tailed).

Ethics

This study was conducted according to the guidelines laid down in the Declaration of Helsinki, the South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research. All procedures involving human subjects were approved by the Ethics Sub-Committee (Humanities and Social Sciences) of the University of KwaZulu-Natal (UKZN) (protocol reference number: HSS/0271/013D). Written informed consent was obtained from all participants.

Results

Urban school learners had a more diverse ethnic background, whereas peri-urban school learners were predominantly Black African. Grade 10 and 11 learners from the urban school were younger than their counterparts at the peri-urban school.

Table 1: Characteristics of study population

	Urban (Q5) [N =98]	% of entire group	Peri-Urban (Q1) [N=111]	% of entire group
Grade 9	36	17.2	30	14.4
Grade 10	39	18.7	46	22.0
Grade 11	23	11.0	35	16.7
Black	30	14.4	108	51.7
White	56	26.8	0	0
Coloured	7	3.3	3	1.4
Indian	5	2.4	0	0
Male	56	26.8	65	31.1
Female	42	20.1	46	22.0
Age range (y)	14.33 – 17.5		14.16 – 21.83	

Overall

The nutrition status of the entire group adolescent learners from the urban and peri-urban school is shown in Tables 2 and 3**.**

Using WHO cut-off values for BMI-for-age (UNICEF), the prevalence of overweight in the peri-urban school was reported as 10% (n=3), 18.9% (n=7), and 12.5% (n=2) for grades 9, 10 and 11 respectively. The obesity prevalence for grades 9, 10 and 11 were 13.3=% (n=4), 10.8% (n=4), and 0% respectively (Table 2).

In the urban school, overweight prevalence was 19.4% (n=7), 23.1% (n=9) and 8.7% (n=2) respectively across grades 9-11. Obesity prevalence was 11.1% (n=4), 17.9% (n=7) and 21.7% (n=5) across grades 9-11 respectively (Table 2).

Using WHO cut-off values for height-for-age (UNICEF), stunting in the peri-urban school was reported as 10% (n=3), 8.1% (n=3) and 31.2% (n=5) in grades 9, 10, and 11. Stunting was considerably lower in the urban school, with a 2.8% (n=1) prevalence in grade 9 (Table 3).

Table 2: Overall overweight and obesity prevalence in grades 9-11 from urban and peri-urban school

Classification	Grade 9		Grade 10		Grade 11	
	Urban (N=36)	Peri-Urban (N=30)	Urban (N=39)	Peri-Urban (N=37)	Urban (N=23)	Peri-Urban (N=16)
Overweight [%]	19.4 (n=7)	10 (n=3)	23.1 (n=9)	18.9 (n=7)	8.7 (n=2)	12.5 (n=2)
Obese [%]	11.1 (n=4)	13.3 (n=4)	17.9 (n=7)	10.8 (n=4)	21.7 (n=5)	0 (n=0)

BMI-for-age:

Overweight > +1SD (25kgm $^{-2}$ at 19 yrs)

Obese >+2SD (BMI 30 kg m $^{-2}$ at 19 yrs)

Table 3: Overall stunting prevalence in grades 9-11 from urban and peri-urban school

Classification	Grade 9		Grade 10		Grade 11	
	Urban (N=36)	PeriUrban (N=30)	Urban (N=39)	Peri-Urban (N=37)	Urban (N=23)	Peri-Urban (N=16)
Moderate	2.8	10	0	8.1	0(n=0)	31.2

Stunting [%]	(n=1)	(n=3)	(n0)	(n=3)	(n=5)

Height-for-age: Moderate stunting: <-2SD and >-3SD

Gender

The nutrition status of learners was stratified according to gender.

Girls

In the urban school, grade nine girls had a 14.3% (n=3) prevalence of overweight and a 4.8% (n=1) prevalence of obesity. In the peri-urban school, grade nine girls had a similar overweight prevalence of 14.3% (n=2), but a higher obesity prevalence of 21.4% (n=3). Grade 10 girls from the urban school had an overweight prevalence of 20% (n=3), and an obesity prevalence of 6.7% (n=1). Among grade 10 girls in the peri-urban school, overweight was almost double that of the urban school at 38.9% (n=7), and the obesity prevalence was also higher at 16.7% (n=3). In grade 11, urban school girls had an overweight prevalence of 16.7% (n=1), which was lower than the overweight prevalence among peri-urban girls [15.4% (n=2)]. There was no obesity prevalence among either urban or peri-urban girls (Table 4).

In grade nine urban school girls reported a stunting prevalence of 2.8% (n=1). A prevalence of 14.3% (n=2) was observed among peri-urban school girls in grade nine, and 23.1% (n=3) in grade 11. One grade 11 peri-urban school girl was reported to be both moderately stunted and overweight. There were no incidences of stunting in grades 10 in the peri-urban school and grades 10 and 11 in the urban school (Table 5).

Among grade nine girls, a significantly higher mean height was observed in the urban school compared to the peri-urban school (1.6 ± 0.1 m versus 1.5 ± 0.04 m respectively; $p<0.01$), as well as a higher mean height-for-age (-0.3 ± 1.2 m vs. -1.2 ± 0.7 m respectively; $p<0.05$). Mean BMI was higher in peri-urban girls than urban girls (24.8 ± 5.0 kg m^{-2} vs. 21.9 ±3.3 kg m^{-2} respectively; $p<0.05$). In grade 10, girls from the peri-urban school had a significantly higher mean weight compared to girls from the urban school (64.3 ± 14.2 kg versus 56.4 ± 7.7 kg respectively; $p<0.05$) In grade 11, girls from the peri-urban school had a significantly higher mean MUAC compared to girls from the urban school (29.0 ±2.3 cm versus 26.6 ±1.5 cm respectively; $p<0.05$) (Table 6).

Table 4: Overweight and obesity prevalence in grade 9-11 girls from urban and peri-urban school.

Classification	Grade 9		Grade 10		Grade 11	
	Urban (N=21)	Peri-Urban (N=14)	Urban (N=15)	Peri-Urban (N=18)	Urban (N=6)	Peri-Urban (N=13)
Overweight [%]	14.3 (n=3)	14.3 (n=2)	20 (n=3)	38.9 (n=7)	16.7 (n=1)	15.4 (n=2)
Obese [%]	0.8 (n=1)	21.4 (n=3)	6.7 (n=1)	16.7 (n=3)	0 (n=0)	0 (n=0)

Table 5: Stunting prevalence in grades 9-11 girls from urban and peri-urban school

Classification	Grade 9		Grade 10		Grade 11	
	Urban (N=21)	Peri-Urban (N=14)	Urban (N=15)	Peri-Urban (N=18)	Urban (N=6)	Peri-Urban (N=13)
Moderate Stunting [%]	4.8 (n=1)	14.3 (n=2)	0 (n=0)	0 (n=0)	0 (n=0)	23.1 (n=3)

Table 6: Mean anthropometric measurements of grade 9-11 girls from the urban versus the peri urban school

Girls	Grade 9		Grade 10		Grade 11	
	Urban (N=21)	Peri-Urban (N=14)	Urban (N=15)	Peri-Urban (N=18)	Urban (N=6)	Peri-Urban (N=13)
Weight (kg)	56.1	58.4	56.4*	64.3*	55.5	57.4
Height (m)	1.60**	1.50**	1.60	1.60	1.60	1.60
MUAC (cm)	25.5	27.5	26.9	28.2	26.6*	29.0*
BMI (kgm^{-2})	21.9*	24.8*	22.2	25.2	22.8	23.6
BMI-for-age	0.4	1.0	0.4	0.2	0.9	-0.5
Height-for-age	-0.3*	-1.2*	-0.4	-0.6	0.2	-1.1

Rows with the symbol * or ** differ significantly between urban and peri-urban groups for the same anthropometric variable

* = ($p<0.05$); ** = ($p<0.01$)

Boys

Amongst grade nine boys, the urban school had an overweight prevalence of 26.7% (n=4) and an obesity prevalence of 20% (n=3). In the peri-urban school, the overweight and obesity prevalence was lower at 6.3% (n=1). In grade 10, urban school boys had an overweight and obesity prevalence of 25% (n=6). In the peri-urban school, the obesity prevalence was 3.7%

(n=1) There was no incidence of overweight among grade 10 peri-urban school boys. In grade 11, urban school boys had an overweight prevalence of 5.9% (n=1) and an obesity prevalence of 29.4% (n=5). Peri-urban school boys had no prevalence of overweight or obesity (Table 7).

In grade nine boys, a higher mean weight was observed in the urban school compared to the peri-urban school (76.4 ±22.6 kg versus 58.1 ±12.1 kg respectively; $p<0.01$), as well as a mean MUAC (31.0 ±6.2 cm versus 26.3 ±3.2 cm respectively; $p<0.05$) and BMI-for-age (1.1 ±1.6 versus 0.03 ±1.1 respectively; $p<0.05$). A higher mean height and height-for-age was observed in the urban school compared to the peri-urban school (height: 1.8 ±0.1 m versus 1.7 ±0.1 m respectively; $p<0.01$) (height-for-age: 0.5 ±0.8 versus -0.7 ±0.9 respectively; $p<0.01$). In the peri-urban school, moderate stunting prevalence of 6.3% (n=1), 11.1% (n=3), and 9.1% (n=2) were observed in grades 9, 10 and 11 respectively. There were no incidences of stunting amongst boys in the urban school (Table 8).

Grade 10 followed the same trend as urban school boys had a higher mean weight, MUAC and BMI-for-age than boys in the peri-urban school [weight: 75.0 ±16.6 kg versus 59.8 ±8.2 kg, respectively ($p<0.05$); BMI-for-age: 1.1 ±1.1 versus 0.4 ±1.3 respectively ($p<0.05$); MUAC: 31.8 ±5.6 cm versus 26.5 ±2.8 cm respectively ($p<0.01$)]. Likewise, a higher mean height and height-for-age was observed in the urban school compared to the peri-urban school [height: 1.7 ±0.1 m versus 1.7 ±0.1 m respectively ($p<0.01$); height-for-age: 0.2 ±0.9 versus -0.7 ±1.2 respectively ($p<0.01$)] (Table 9).

In grade 11, urban school boys had a higher mean weight, height and height-for-age than peri-urban school boys [weight: 75.0 ±17.5 kg versus 60.3 ± 6.8 kg respectively ($p<0.01$); height: 1.8 ± 0.1 m versus 1.7 ± 0.1 m respectively ($p<0.01$); height-for-age: 0.2 ± 1.2 versus -1.2 ± 1.1 respectively ($p<0.01$)] (Table 9).

Table 7: Overweight and obesity prevalence in grade 9-11 boys from urban and peri-urban school

Classification	Grade 9		Grade 10		Grade 11	
	Urban (N=15)	Peri-Urban (N=16)	Urban (N=24)	Peri-Urban (N=27)	Urban (N=17)	Peri-Urban (N=22)
Overweight [%]	26.7 (n=4)	6.3 (n=1)	25 (n=6)	0 (n=0)	5.9(n=1)	0 (n=0)
Obese [%]	20 (n=3).	6.3 (n=1)	25 (n=6)	3.7 (n=1)	29.4 (n=5)	0 (n=0)

Table 8: Stunting prevalence in grade 9-11 boys from urban and peri-urban school

Classification	Grade 9		Grade 10		Grade 11	
	Urban (N=36)	Peri-Urban (N=16)	Urban (N=39)	Peri-Urban (N=45)	Urban (N=23)	Peri-Urban (N=35)
Moderate Stunting	0 (n=0)	6.3 (n=1)	0 (n=0)	11.1 (n=3)	0 (n=0)	9.1 (n=2)

Table 9: Mean anthropometric measurements of grade 9-11 boys from the urban and peri urban school

Boys	Grade 9		Grade 10		Grade 11	
	Urban (N=15)	Peri-Urban (N=16)	Urban (N=39)	Peri-Urban (N=45)	Urban (N=23)	Peri-Urban (N=35)
Weight (kg)	76.4**	58.1**	75.0**	59.8**	75.0**	60.3**
Height (m)	1.8**	1.7**	1.7**	1.7**	1.8**	1.7**
MUAC (cm)	30.9*	26.3*	31.8**	26.5**	31.1	29.5
BMI (kg m $^{-2}$)	25.2	21.1	24.8	22.3	23.7	21.5
BMI-for-age	1.1*	0.03*	1.1*	0.4*	0.6	0.2
Height-for-age	0.5**	-0.7**	0.2**	-0.7**	0.2**	-1.2**

Rows with the symbol * or ** differ significantly between urban and peri-urban groups for the same anthropometric variable* = ($p<0.05$) ** = ($p<0.01$)

Discussion

Data from the socio-demographic questionnaire (not shown) revealed that parental education and employment status among learners from the urban school were higher than that of the peri-urban school, which is indicative of the differences in socioeconomic status of the learners participating in this study.

Overall, a higher prevalence of overweight and obesity was observed in the urban school than the peri-urban school across all grades (Table 2). However, when stratified according to gender, the majority of overweight and obesity incidences were attributed to the boys, which were higher than their peri-urban counterparts (Table 7). This was reflected in the significant differences in mean weight in grades 9 to 11, with significantly higher MUAC and BMI-for-age in grades 9 and 10 (Table 9). In the peri-urban school, overweight and obesity were attributed to the girls, who had significantly higher weight and MUAC than urban school girls in grades 10 and 11 respectively.

Interestingly, the urban school boys had a higher prevalence of overweight and obesity than the girls, whereas the opposite was observed in the peri-urban school, as girls had higher prevalences than the boys. These results indicate a higher prevalence of overweight and obesity among adolescent girls from peri-urban areas.

Whilst overweight/obesity was lower among peri-urban school boys, moderate stunting was considerably more prevalent, with significantly lower height and height-for-age than urban school boys in all grades (Table 9). In spite of high overweight/obesity prevalence, peri-

urban girls had an even higher moderate stunting prevalence (Tables 4 and 5). Grade nine peri-urban girls had a significantly lower height-for-age, and there was one grade 11 girl reported as both overweight and moderately stunted (Table 6). In addition, similar prevalences of overweight, obesity and moderate stunting was observed among both grade 9 boys and girls from the peri-urban school (Tables 2 and 3). This may be indicative of a double burden of overweight/obesity and stunting amongst adolescents within this peri-urban population.

Results from this study correlates with existing data from South Africa, however there is little that highlights the coexistence of stunting and overweight/obesity among adolescents. Adolescents from the North West Province were investigated, and an overall stunting prevalence of 19% was shown, with a higher prevalence in rural areas and among boys. Although no significant relationship between stunting and overweight/obesity was found, it was observed that girls older than 14 years had increases in subcutaneous fat in spite of the stunting prevalence (Kruger *et al*., 2005).

Similarly, data from the first South African Youth Risk Behaviour Survey (2002) involving Black adolescents in grades 8–11, revealed a significantly higher stunting prevalence in boys than girls (Reddy *et al*., 2003). Also, overweight prevalence among girls were significantly higher than boys. Research conducted among rural South African adolescents, females aged 15-20 were up to four times more obese than males in the same age group (Kimani-Murage, 2013).

Conclusion

A potential coexistence of overweight/obesity and stunting, particularly in adolescent girls from peri-urban areas is indicated by these results. The higher prevalence of overweight and obesity among peri-urban school girls reflects a possibly higher risk of obesity-related issues such as pregnancy complications, as well as the development of NCDs in adulthood. Likewise, the study suggests an increased risk of undernutrition among boys from peri-urban areas due to the higher incidence of stunting observed. Results may have been affected by the small sample between the two participating schools. Hence further research involving a larger sample size is warranted to yield results that can be considered more representative of the entire population.

Acknowledgments: The principals of the two consecutive schools where data was collected; fieldworkers who assisted with data collection; the participants from both schools

Conflict of Interest: None

Authorship

Frederick Veldman was the final editor and contributed to the statistical analysis of data presented in the results section. Susanna Kassier drafted the methodology section and was the first editor. Keiron Audain was the main author and contributed to the introduction as well as the data analysis and interpretation in the discussion and conclusion.

Adolescent food frequency and socio-economic status in a private urban and peri-urban school in Hilton, KwaZulu-Natal

Audain KA, BSc, MSc, MedBiochem, PhD Student; **Kassier SM,** MSc Dietetics, RD, Lecturer
Veldman FJ, PhD Nutrition, RN, Professor and Head of Department
Discipline of Dietetics and Human Nutrition, University of KwaZulu-Natal
Correspondence to: Keiron Audain, e-mail: keiron.audain@gmail.com
Keywords: food frequency, adolescents, nutrition transition, socioeconomic status, household food insecurity

Abstract

Objective: The objective of the study was to make a comparative analysis of the dietary preferences of adolescents attending an urban versus a peri-urban school in KwaZulu-Natal, in order to investigate the association between socio-economic status and food frequency.

Design: The design was a cross-sectional descriptive survey.

Setting: The setting was an urban and peri-urban high school in Hilton, KwaZulu-Natal.

Subjects: One hundred and eleven grade 9-11 learners from a peri-urban school, and 98 grade 9-11 learners from an urban school, volunteered to participate.

Outcome measures: A non-quantified food frequency questionnaire was used to assess food frequency. A socio-demographic questionnaire developed for the purpose of this study was utilised to collect information on parental education, employment status and household or accommodation data. A Household Food Insecurity Access Scale questionnaire was used to determine the household food insecurity of the learners.

Results: The findings indicated that there was a higher preference for globalised foods (high in fat and sugar), particularly fast food, by learners from the peri-urban school (p-value < 0.01). These learners were also more likely to consume locally available, high-fat snacks (p-value < 0.01). Grade 10 urban school learners consumed more red meat and processed meats than their peri-urban school counterparts (p-value < 0.01). Negative correlations were observed between parental education and employment status (particularly of the mothers) and fast food consumption in adolescents (p-value < 0.01).

Conclusion: A high frequency of globalised or energy-dense food intake was associated with low socio-economic status. Although healthy eating habits were generally poor in urban and peri-urban adolescents, food sources varied, possibly owing to cost and availability. The importance of a diverse diet and the inclusion of a wider range of affordable, nutrient-rich foods should be promoted in the school setting, and also to parents, particularly those of a lower socio-economic status.

Ⓟ Peer reviewed. (Submitted: 2014-03-20 Accepted: 2014-07-19) © SAJCN S Afr J Clin Nutr 2014;27(4):201-207

Introduction

Dietary habits have steadily shifted from traditional to more "globalised" foods in many low- and middle-income countries. Food items that are high in sugar, sodium, saturated fat and animal protein are now commonly consumed, most notably in socio-economically deprived areas.[1-3]

Adolescents, in particular, are experiencing this nutrition transition as they are routinely targeted by media advertising for globalised foods[3-5] and fast food restaurants.[6] As independent eating habits are usually formed during adolescence,[7] this is believed to be an important influence which contributes to nutritionally poor diets in adolescents.[8]

In South Africa, food items such as fizzy drinks, sweets and potato chips (crisps) are regularly consumed by adolescents.[8] The popularity of these foods, because of their energy density, accessibility and affordability, is one of the primary barriers to healthy eating in adolescents, particularly those from low-income areas.[8,9] Thus, when cost is a factor, adolescents may be more likely to choose a less healthy food option to meet their energy requirements.[2] In addition, many adolescents may perceive unhealthy foods to taste better and hence to be more desirable than healthy foods.[9] However,

key micro- and macronutrients necessary for sustaining optimum health are lacking in these foods.[2]

An estimated 23% of the global adolescent population resides in sub-Saharan Africa.[10] Approximately 20% of the total population (10.2 million) in South Africa is between the ages of 10 and 19 years.[10] From a nutritional perspective, adolescence is an important life stage, characterised by rapid growth.[7,11] Nutrient deficiencies caused by an inadequate diet can affect growth and sexual maturation.[7,11,12] A low intake of nutrient-dense foods in adolescence has also been linked to behavioural problems, including depression, a low attention span, regular late coming and/or absenteeism and poor academic performance,[13,14] an association which requires considerable attention, particularly when considering the multifactorial nature of behavioural disorders.

Furthermore, poor diet quality in adolescence can increase the risk of the development of noncommunicable diseases (NCDs) in adulthood, including cardiovascular disease, hypertension and type 2 diabetes.[1,15] The emergence of NCDs in middle-income countries, such as South Africa, has been linked to nutrition transition and a high rate of infectious disease in these countries, which together cause a "double burden" of disease.

Nationally, South Africa is considered to be a food-secure country. However, many individuals remain vulnerable to food insecurity at household level.[16] The General Household Survey of 2007 estimated that 10.6% of adults and 12.2% of children were food insecure.[17] However, according to the first results of the South African National Health and Nutrition Examination Survey (SANHANES-1), published in 2013, only 43.7% of South African households are food secure, which indicates that the prevalence of food insecurity is rising.[18] The ability to purchase sufficient and nutritious food largely depends on household income. Hence, low-income households are generally expected to be more food insecure, and often exhibit coping strategies, such as the consumption of a less diversified and less nutritious diet overall.[7]

The South African food-based dietary guidelines were designed to assist the population to achieve dietary diversity and to address nutrition-related public health issues, such as undernutrition and obesity.[19] Yet, according to SANHANES-1, only 4.6% of South African adolescents follow the recommended guidelines with regard to the consumption of fruit and vegetables.[18] Dietary intake has been shown to have a strong association with socio-economic status, particularly in low- to middle-income countries, in which dietary diversity is rarely achieved in low-income households.[20]

Conversely, households with a higher income follow a more diverse diet.[21] Therefore, it is largely believed that improving socio-economic conditions results in an improvement in dietary intake by increasing access to a wider range of quality foods.[22]

To date, there has been limited research on the association between socio-economic status and food frequency in adolescents, particularly in low- to middle-income countries. This is an important public health issue, given the risk of NCDs developing in later years as the majority of adolescents in the world live in low- to middle-income countries.[18] NCDs are responsible for 36 million deaths each year, while roughly 29 million occur in low- to middle-income countries.[23]

Method

Study objectives

The aim of this study was to compare the food frequency of adolescent learners from an urban school with that of those in a peri-urban school in Hilton, KwaZulu-Natal. Although these schools are in very close geographical proximity to each other, they have a differing socio-economic status.

Study population, design and methods

The study population in this cross-sectional descriptive study consisted of grade 9-11 adolescents from two secondary schools; one a private urban school and the other a peri-urban school, both situated in Hilton. Hilton is a small town situated on the outskirts of Pietermaritzburg in KwaZulu-Natal. The private urban school runs an outreach programme which formally trains the principals and teachers of schools from peri-urban communities within the Hilton area. Also, learners from the private urban school mentor learners from the peri-urban school.

Secondary schools in South Africa are classified according to national and provincial quintiles, ranging from 1-5.[24] Classification is based on socio-economic information from the catchment area in which the school is located, and includes parental income, education level and employment status.[22] Quintile 1 (Q1) schools cater to the 20% of learners with the lowest socio-economic status, while Q5 schools cater to the 20% of learners with the highest socio-economic status.[24] In this study, the private urban school is classified as a Q5 school with a diverse learner population (black, Indian, white and coloured pupils). The peri-urban school is classified as a Q1 school with predominantly black learners. Participants fell within a younger age range of 14-17 years at the private urban school, whereas participants were aged 14-21 years at the peri-urban school.

A total of 209 learners, 98 from the private school and 111 from the peri-urban school, volunteered to participate in the study, which was executed between June and August 2013. Participants were briefed on the study objectives in either English or *isiZulu,* and asked to sign an informed consent form. Learners in grades 8 and 12 were excluded from the study. For the purposes of the study, it was assumed that the participants responded sincerely and truthfully.

The questionnaires used in this study were self-administered and included a non-quantified food frequency questionnaire (FFQ), a socio-demographic questionnaire and a Household Food Insecurity Access Scale (HFIAS) questionnaire.

The FFQ was adapted by six South African dietitians for the purpose of determining the eating habits and traditional food consumption of urban Zulu women.[25] It provided eight consumption choices for 61 foods. The food items were grouped into eight categories according

to the similarity of nutritional content as follows: starches, vegetables, fruit, dairy, meat, fast food or takeaways, snacks and drinks.

Responses to consumption frequency were assigned values ranging from 0-8:

- A score of 0: Never or less than once per month.
- A score of 1: 1-3 times a month.
- A score of 2: Once a week.
- A score of 3: 2-4 times a week.
- A score of 4: 5-6 times a week.
- A score of 5: Once a day.
- A score of 6: 2-3 times a day.
- A score of 7: 4-5 times a day.
- A score of 8: Six or more times a day.

A socio-demographic questionnaire was developed for the purpose of this study to collect information on parental education, employment and household or living arrangements.

In addition, the HFIAS[26] consists of nine questions that investigate whether or not the household experienced one or more types of food insecurity in the past four weeks, and if so, with what frequency. The HFIAS score measures the extent of food insecurity. Each question consists of two parts. Part A contains two possible responses of "yes" and "no", and Part B ("How often did this happen?") contains three possible responses of "rarely", "sometimes" or "often". The score ranges from 0-27, and the higher the score, the greater the extent of household food insecurity. The HFIAS-related conditions provide an indication of the percentage of households experiencing a specific condition in accordance with the possible responses of "rarely", "sometimes" or "often".[26]

At the time of the study, learners attending both the urban and peri-urban school were living at home. The individual HFIAS score was calculated for each learner by totalling the responses to the nine questions on food insecurity-related conditions. The average HFIAS score for each grade was then calculated using the following equation:

$$\frac{\text{Sum of HFIAS scores in each grade}}{\text{Number of HFIAS scores, i.e. households, in each grade.}}$$

Specific HFIAS-related conditions were investigated in the study with the following questions:

- *Question 3 (Q3):* In the past four weeks, did you have to eat a limited variety of foods due to a lack of money?
- *Question 7 Q7):* In the past four weeks, was there ever no food to eat of any kind in your household because of lack of money to obtain food?

The number of households experiencing one of these conditions at any given time was calculated using the following equation:

$$\frac{\text{Number of households with response of 1 to Q3/Q7}}{\text{Total number of households responding to Q3/Q7}} \times 100.$$

The number of households experiencing these conditions "often" was calculated using the following equation:

$$\frac{\text{Number of households with response of "often" to Q3b/Q7b}}{\text{Total number of households responding to Q3/Q7}} \times 100.$$

Participants from the peri-urban school were given the option of self-administered questionnaires in English or *isiZulu*. The questionnaires were piloted to five random grade 10 learners from both schools to ensure simplicity and straightforwardness. Data were collected by bilingual and appropriately trained fieldworkers who were available to assist participants if and when necessary.

The results were analysed using SPSS® 19. Statistical associations between the categorical variables were analysed using Pearson's chi-square test. A p-value of 0.05 was considered to be significant.

The study was approved by the Ethics Subcommittee (Humanities and Social Sciences) of the University of KwaZulu-Natal (Protocol Reference No. HSS/0271/013D), and was conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African *Guidelines for good clinical practice,* and the Medical Research Council *Ethical guidelines for research.*

Results

Study population characteristics

The characteristics of the study population are summarised in Table I.

Table I: Characteristics of the study population

Characteristics	Urban (Q5) n = 98	% of group	Peri-urban (Q1) n = 111	% of group
Grade				
Grade 9	36	36.7	30	27
Grade 10	39	39.8	46	41.4
Grade 11	23	23.5	35	31.5
Race				
Black	30	30.6	108	97.3
White	56	57.1	0	0
Coloured	7	7.1	3	2.7
Indian	5	5.1	0	0
Gender				
Male	56	57.1	65	58.6
Female	42	42.9	46	41.4
Age				
Age range (years)	14 years, 4 months to 17 years 6 months		14 years, 2 months to 21 years, 10 months	

Q: quintile

Learners from the urban school had a diverse ethnic background, whereas peri-urban school learners were predominantly black Africans. Grade 10 and 11 learners from the peri-urban school were older than their counterparts at the urban school.

Overall, the peri-urban school learners reportedly had a higher intake frequency with regard to the following foods (Table II).

Table II: Mean frequency of intake scores for specific foods that differed significantly between the urban and peri-urban schools

Food groups	Foods	Urban (Q5)	Peri-urban (Q1)
Starches	Rice, mealie rice, samp, *phutu*, pap and *jeqe* (steamed bread)	0.80 ± 1.50	1.64 ± 2.18*
	Refined breakfast cereals	0.90 ± 1.57	1.34 ± 1.99*
	Potato cooked with added fat, e.g. margarine	0.48 ± 0.93	1.13 ± 1.67*
Vegetables	Vegetables prepared with sugar, fat or other sauces	0.76 ± 1.43	1.10 ± 1.66*
Fruit	Fresh fruit	1.81 ± 1.88	1.64 ± 2.28**
Dairy	Cheese (full fat)	0.94 ± 1.28	1.11 ± 1.84*
Meats	Sausages (Vienna, Russian and frankfurters)	0.46 ± 0.90	1.11 ± 1.79*
Fast foods	Pizza, pies, French fries, fried chicken, hot dogs and hamburgers	0.28 ± 0.72	1.18 ± 1.83*
Snacks	Local high-fat snacks: *Vetkoek* and samosas	0.29 ± 0.88	0.85 ± 1.48*
	Potato chips (crisps)	0.60 ± 1.21	1.30 ± 1.89
Drinks	Soft fizzy drinks	1.22 ± 2.03	1.27 ± 1.90
	Milkshakes	0.50 ± 1.29	1.08 ± 1.64*

Q: quintile
Rows with the symbol * or ** differ significantly between the urban and the peri-urban groups for the same foods
*p-value < 0.05
**p-value < 0.01

Learners from the peri-urban school reportedly consumed more foods prepared outside of the home (0.88 ± 1.69 vs. 0.31 ± 0.83, p-value < 0.01). Learners from the urban school consumed more fresh fruit than the peri-urban school learners (1.81 ± 1.88 vs. 1.64 ± 2.28, p-value < 0.05).

Grade 9 learners from the urban school consumed more fresh fruit than the grade 9 peri-urban school learners (2.15 ± 1.94 vs. 1.76 ± 2.39, p-value < 0.05). In grade 10, the urban school learners reportedly consumed more whole grain breakfast cereals (1.66 ± 2.21 vs. 0.56 ± 1.18, p-value < 0.01), red meat with visible fat (beef, mutton and pork) (1.43 ± 2 vs. 0.32 ± 0.63, p-value < 0.01), processed meats (1.12 ± 2.02 vs. 0.56 ± 0.92, p-value < 0.01), and fizzy drinks (1.56 ± 2.27 vs. 0.70 ± 1.28, p-value < 0.01), than the peri-urban school learners. Grade 10 learners from the peri-urban school reportedly consumed more fast food than the urban school learners, including pies (0.93 ± 1.66 vs. 0.37 ± 1.04, p-value < 0.05), fried chicken, fried fish, "bunny chow" and hot dogs (0.57 ± 1.79 vs. 0.213 ± 1.26, p-value < 0.01). Learners from the peri-urban school also reportedly consumed more local high-fat snacks (*vetkoeks* and samosas) (0.97 ± 1.76 vs. 0.31 ± 0.99, p-value < 0.01).

Grade 11 peri-urban school learners had a similar diet to the grade 10 and grade 9 learners, but consumed some healthier foods more than the urban school, including mixed salad (1.28 ± 2.04 vs. 0.69 ± 0.92, p-value < 0.01), fresh fruit (1.77 ± 2.25 vs. 1.21 ± 1.03, p-value < 0.01), and whole wheat bread (0.85 ± 1.40 vs. 0.37 ± 0.94, p-value < 0.05). Grade 11 learners from the urban school were reported to consume more white and brown bread (1.99 ± 1.61 vs. 1.89 ± 2.30, p-value < 0.05) than the peri-urban school learners.

Gender differences

Varied consumption patterns were observed between the boys and the girls. For the entire group, significance pointed towards the boys having higher food consumption frequency for several food items.

At the urban school, boys significantly ate more chicken without skin (0.89 ± 1.77 vs. 0.45 ± 1.04, p-value < 0.01), fast foods (0.44 ± 1.20 vs. 0.26 ± 0.45, p-value < 0.05), and chocolate (1 ± 1.88 vs. 0.75 ± 1.11, p-value < 0.05) than the girls. Girls reportedly consumed more refined breakfast cereals than the boys (1.19 ± 1.91 vs. 0.67 ± 1.22, p-value < 0.01), and were more likely to bring food from home to consume during the day (1.48 ± 2.04 vs. 1.13 ± 1.52, p-value < 0.05). Of the peri-urban school participants, significant differences in consumption frequency between the boys and girls were observed.

Boys significantly consumed more white/brown bread (1.67 ± 2.31 vs. 1.11 ± 1.77, p-value < 0.01), pasta (0.89 ± 1.52 vs. 0.46 ± 0.98), mixed salad (1.40 ± 2.01 vs. 0.76 ± 1.60, p-value < 0.01), fresh fruit (1.80 ± 2.47 vs. 1.41 ± 2, p-value < 0.01), processed meat (1.26 ± 1.86 vs. 0.82 ± 1.43, p-value < 0.01) and tinned fish (1.08 ± 1.88 vs. 0.75 ± 1.28, p-value < 0.01). Also, peri-urban school boys consumed more food prepared outside the home than the peri-urban school girls (1.10 ± 1.97 vs. 0.62 ± 1.20, p-value < 0.01) (Table III).

Socio-demographic information

Parental education levels were higher in the urban school than in the peri-urban school, particularly with respect to grade 11 pupils, where 56.5% of the mothers of the learners in the urban school had obtained a tertiary education, compared to 3% of those in the peri-urban school. A similar gap was observed with regard to the fathers' education levels, in which tertiary education was approximately nine times higher for grade 11 urban school learners than their peri-urban school counterparts (Table IV). The mothers' education had a strong negative correlation with the consumption of any type of fast food in learners (p-value < 0.01, r = –0.269). A negative correlation was also observed between the mothers' education and the consumption of sausages (p-value < 0.01, r = –0.257), processed meats (p-value < 0.05, r = –0.187), refined cereals (p-value < 0.05, r = –0.152) and local high-fat snacks (p-value < 0.05, r = –0.162). In addition, the mothers' education correlated negatively with the consumption by the learners of fizzy drinks (p-value < 0.05, r = –0.167) and milkshakes (p-value < 0.01, r = –0.220), with eating outside of the home (p-value < 0.05, r = –0.178) and buying food to eat during the day (p-value < 0.01, r = –0.249). The same negative correlation was noted between the fathers' education level and the consumption of fast food (p-value < 0.01, r = –0.217), milkshakes (p-value < 0.05, r = –0.167) and eating out (p-value < 0.05, r = –0.177).

Table III: The mean food frequency of the boys as opposed to that for the girls at each school

Food groups	Foods	Urban (Q5)		Peri-urban (Q1)	
		Boys	Girls	Boys	Girls
Starches	Cooked potatoes without fat	0.83 ± 1.44	0.58 ± 0.95	1.10 ± 1.81*	0.53 ± 0.67
	Whole grain breakfast cereals	1.06 ± 1.51	1.36 ± 1.87	1.27 ± 2.01*	0.64 ± 1.06
	Refined breakfast cereals	0.67 ± 1.22	1.19 ± 1.91*	1.31 ± 2.02	1.36 ± 1.99
	Whole wheat and low GI bread	0.50 ± 0.91	0.60 ± 1.06	1.27 ± 2*	0.63 ± 1.12
	White or brown bread	2.08 ± 1.96	1.46 ± 1.77	1.67 ± 2.31**	1.11 ± 1.77
	Pasta (macaroni and spaghetti)	0.67 ± 1.27	0.78 ± 1.22	0.89 ± 1.52**	0.46 ± 0.98
Vegetables	Cooked vegetables with sugar or fat	0.90 ± 1.64	0.59 ± 1.09	1.44 ± 1.96*	0.66 ± 1.02
	Mixed salad (lettuce and cucumber)	0.86 ± 1.33	1.01 ± 1.52	1.40 ± 2.01**	0.76 ± 1.60
Fruit	Fresh fruit	1.87 ± 1.99	1.74 ± 1.75	1.80 ± 2.47**	1.41 ± 2
Dairy	Full-cream milk	1.58 ± 2.11	1.57 ± 1.97	1.66 ± 2.28*	1.10 ± 1.72
Meats	Sausages (Vienna and Russian)	0.40 ± 0.67	0.54 ± 1.13**	1.45 ± 2.08	0.69 ± 1.21
	Processed meat (polony and bacon)	0.70 ± 1.46	0.76 ± 1.58**	1.26 ± 1.86**	0.82 ± 1.43
	Tinned fish (sardines and pilchards)	0.33 ± 1.04	0.33 ± 0.96	1.08 ± 1.88**	0.75 ± 1.28
	Chicken without skin	0.89 ± 1.77*	0.45 ± 1.04	0.91 ± 1.82	1.07 ± 1.58
Fast food	Pizza, pies, French fries and fried chicken	0.44 ± 1.20**	0.26 ± 0.45	1.22 ± 1.95*	0.96 ± 1.39
Snacks	Chocolate	1 ± 1.88**	0.75 ± 1.11	1.13 ± 1.97	1.88 ± 2.23
Drinks	Fizzy soft drinks	1.17 ± 1.94	1.29 ± 2.17	1.41 ± 2.15**	1.10 ± 1.53
	Milkshakes	0.58 ± 1.47	0.38 ± 1	1.41 ± 1.97*	0.66 ± 0.95

GI: glycaemic index, Q: quintile
Rows with the symbol * or ** differ significantly between the boys and the girls in the same school for the same food
*p-value < 0.05
**p-value < 0.01

Table IV: Parental education according to grade in the urban and peri-urban school

Mother's education	Grade 9 urban (n = 36)	Grade 9 peri-urban (n = 26)	Grade 10 urban (n = 38)	Grade 10 peri-urban (n = 41)	Grade 11 urban (n = 23)	Grade 11 peri-urban (n = 30)
Primary	2.7%	15.4%	0%	12.2%	0%	13.3%
Secondary	25%	61.5%	13.2%	70.7%	43.5%	83.3%
Tertiary	72.2%	23.1%	86.8%	17.1%	56.5%	3.3%
Father's education	**Grade 9 urban (n = 32)**	**Grade 9 peri-urban (n = 25)**	**Grade 10 urban (n = 37)**	**Grade 10 peri-urban (n = 38)**	**Grade 11 urban (n = 23)**	**Grade 11 peri-urban (n = 27)**
Primary	0%	12%	0%	15.8%	0%	7.4%
Secondary	15.6%	44%	21.6%	44.7%	30.4%	85.2%
Tertiary	84.4%	44%	78.4%	39.5%	69.6%	7.4%

Table V: Parental employment according to grade in the urban and peri-urban school

Mother's employment	Grade 9 urban (n = 34)	Grade 9 peri-urban (n = 27)	Grade 10 urban (n = 38)	Grade 10 peri-urban (n = 35)	Grade 11 urban (n = 22)	Grade 11 peri-urban (n = 29)
Full-time	70.6%	63%	68.4%	45.7%	68.2%	55.2%
Part-time	20.6%	14.8%	21.1%	28.6%	13.6%	13.8%
Unemployed	0%	7.4%	10.5%	14.3%	18.2%	20.7%
Disabled	0%	11.1%	0%	8.6%	0%	0%
Retired	8.8%	3.7%	0%	2.9%	0%	10.3%
Father's employment	**Grade 9 urban (n = 29)**	**Grade 9 peri-urban (n = 25)**	**Grade 10 urban (n = 35)**	**Grade 10 peri-urban (n = 32)**	**Grade 11 urban (n = 23)**	**Grade 11 peri-urban (n = 25)**
Full-time	89.7%	72%	85.7%	46.9%	87%	68%
Part-time	6.9%	8%	5.7%	18.8%	8.7%	12%
Unemployed	0%	8%	8.6%	12.5%	4.3%	16%
Disabled	0%	8%	0%	6.3%	0%	0%
Retired	3.4%	4%	0%	15.6%	0%	4%

Table VI: Household Food Insecurity Access Scale scores and related conditions

HFIAS	Grade 9 urban (n = 34)	Grade 9 peri-urban (n = 30)	Grade 10 urban (n = 33)	Grade 10 peri-urban (n = 40)	Grade 11 urban (n = 23)	Grade 11 peri-urban (n = 35)
Average HFIAS score	2.09	6.37	0.70	7	0.17	5
Households responding "yes" to Q3* (%)	14.71	40	9.09	45	4.35	37.14
Households responding "often" to Q3* (%)	0	10	3.03	12.50	0	5.71
Households responding "yes" to Q7** (%)	11.76	33.33	9.09	50	0	31.43
Households responding "often" to Q7** (%)	0	3.33	0	5.00	0	2.86

HFIAS: Household Food Insecurity Access Scale, Q: quintile
*Q3: In the past four weeks, did you have to eat a limited variety of foods due to a lack of money?
**Q4: In the past four weeks, was there ever no food to eat of any kind in your household because of lack of money to obtain food?

Parental employment followed a similar pattern. Higher rates of unemployment were observed with respect to the parents of learners from the peri-urban school than those of the urban school, particularly for fathers (Table V).

A positive correlation was observed between participants with mothers in full-time employment and the consumption of healthier options, such as legumes (baked beans, lentils, dahl, harricot beans, split peas, broad beans, kidney beans and sugar beans) (p-value < 0.05, $r = 0.171$) and steamed or grilled fish (p-value $< 0.0.05$, $r = 0.156$).

A positive correlation was also observed between learners with fathers in full-time employment and the consumption of French fries (p-value < 0.05, $r = 0.194$), fried chicken (p-value < 0.01, $r = 0.231$), "bunny chow" (p-value < 0.01, $r = 0.244$) and hot dogs (p-value < 0.05, $r = 0.195$). The same was observed for the consumption of locally available high-fat snacks, such as *vetkoek* and samosas (deep-fried pastries) (p-value < 0.05, $r = 0.180$). There was a positive correlation between learners with fathers who worked full-time and with eating out at restaurants and/or consuming takeaway or prepared meals (p-value < 0.0, $r = 0.200$). There was a negative correlation between learners with fathers who worked part-time and with tinned fish (p-value < 0.01, $r = -0.227$), ice cream (p-value < 0.05, $r = -0.188$), and eating out at restaurants and/or consuming takeaway or prepared meals (p-value < 0.01, $r = -0.211$).

Household food insecurity

The household food insecurity of the learners was assessed using the HFIAS questionnaire. The HFIAS score and the HFIAS-related conditions were calculated using the collected data. The calculated HFIAS scores and HFIAS-related conditions, including frequency, are shown in Table VI. The data revealed a markedly higher level of household food insecurity in peri-urban school learners than in urban school learners. This contrast was particularly noticeable in grade 10 learners. Forty-five per cent of peri-urban school learners reported having to eat a limited variety of foods owing to a lack of money. 12.5% reported that this occurred often over the four weeks prior to data collection. Also, 50% of the grade 10 peri-urban school learners reported having no food to eat of any kind in the household, with 5% stating that it occurred often (Table VI).

Discussion

This study provides insight into the food frequency of South African adolescent learners according to socio-economic status and gender, on which little research has been conducted to date. While it must be acknowledged that the results were not fully representative of the adolescents' actual daily diet, they indicated their dietary preferences and showed what they would most likely consume with increased purchasing power.

In the peri-urban school, the shift in dietary preference from the consumption of more traditional foods (mealie, samp and *phutu*) by the urban school learners in grade nine, to the consumption of more globalised foods (refined breakfast cereals, high-fat snacks, milkshakes and fast food) by learners in the older grades, is indicative of a nutrition transition in South Africa.[1] It is possible that as adolescents grow older and gain more dietary independence from their parents, they make unhealthy food choices based on taste, desire and peer influence,[2] whereas younger adolescents are more likely consume the food prepared at home. Food preparation may also be in transition as the peri-urban school learners reported consuming more vegetables prepared with sugar and/or fat. This may suggest a lack of knowledge of healthy cooking habits, and/or an inability to afford meat on a regular basis, hence vegetables were cooked differently to convey a more "meaty" taste or to be tastier.

In general, nutrient-dense foods are more costly than energy-dense foods.[2] In South Africa, a typical healthier diet (that would replace full-cream milk with fat-free milk, or white bread with whole wheat bread, for example) can be up to 69% more expensive, depending on individual food choices.[2] A survey conducted on tuck shop managers in South Africa revealed the general opinion that it was not cost-effective to stock healthier items, such as canned fruit beverages, as opposed to carbonated or fizzy beverages as the latter were available at a cheaper wholesale price.[27] Thus, cost is a significant factor in the formation of dietary habits, and the high consumption of locally available, high-fat snacks, such as *voetkoeks* and samosas (deep-

fried pastries), by the peri-urban school learners was indicative of this. Yet a high socio-economic status did not necessarily translate into better dietary habits, as higher income levels can increase access to more expensive but less healthy foods, such as fatty red meat and processed meats, as observed in the grade 10 learners at the urban school.

The gender difference in peri-urban school learners was pronounced, and it appeared that in general, the boys consumed more food than the girls. This may indicate a level of disparity between the diet of adolescent boys and that of girls from a lower socio-economic status. Gender disparities in eating habits in food-insecure households in middle- and high-income countries have not been largely reported. However, in poorer countries, such as Ethiopia, adolescent food insecurity varies according to gender, as girls are more likely to be food insecure than boys, despite there being no differences in household food insecurity.[28]

A high level of household food insecurity in peri-urban school learners coincides with lower levels of parental education and employment, and is reflective of a lower socio-economic status. This may relate to the high consumption of local high-fat snacks which are energy dense and may thus satisfy hunger, albeit not nutrient requirements.[2]

Given the role of the adolescent period in human development,[7] and the media influence on fast food purchases,[4] adolescents are increasingly likely to adopt a globalised diet that may increase the risk of nutritional complications. Data from the Transition and Health during Urbanisation in South Africans (THUSA) study, involving 1 257 South African adolescents stratified for gender, type of school and ethnic group, revealed micronutrient intake (vitamin A, folate, ascorbic acid, calcium and iron and zinc) of less than 67% of the recommended dietary allowance for their age group and gender.[29] In addition, rural adolescents reported an even lower micronutrient intake than the urban adolescents.[29]

The negative Pearson product-moment correlation coefficient observed between mothers' education level and the frequency of several unhealthy foods revealed that it was more likely that mothers, rather than fathers, were in control of both the food preparation and dietary education in the household.[30] Parental employment may affect the financial allowance that adolescents receive to spend on food.

Previous data from the Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study indicated a positive correlation between diet quality and both maternal and paternal education and occupation.[31] In addition, it has been shown that the negative impact of fast foods on diet quality was more pronounced in adolescents from low-income households.[32]

Conclusion

Poor dietary habits in general in adolescents were observed in this study, although food sources varied between the urban and peri-urban learners, possibly owing to differences in the cost and availability of food items. A lower socio-economic status was an underlying factor for the consumption of energy-dense foods by peri-urban adolescents, while a higher socio-economic status was associated with the consumption of more expensive fatty foods by urban adolescents. Thus, the risk of obesity and subsequent susceptibility to NCDs may increase in both groups as a result. It is suggested that dietary recommendations that target low-income groups should factor in the affordability of, and access to, high-quality, nutrient-dense foods. At country level, the importance of a balanced, diverse diet should be promoted via media coverage, including television and radio programmes. At community level, nutrition education and self-sustaining, income-generating programmes, such as school gardens for the benefit of learners and their families, must be encouraged. Larger sample sizes are warranted in order to yield results that are more representative of the entire adolescent population.

References available on request

CHAPTER 6
CONCLUSION

Results from this study revealed a notable prevalence of overweight/obesity in both urban and peri-urban learners; and stunting in peri-urban learners. In addition, nutrition knowledge scores (NKS) were significantly higher among urban learners, which were not reflected in their nutritional status or consumption of healthier foods. The consumption frequency of unhealthy foods was high among all learners, albeit different types of food. Nevertheless, this indicates that adolescents from both schools could benefit from a nutritional intervention.

Overall, the overweight and obesity prevalence was higher in the urban school than the peri-urban school. When stratified for gender, the higher BMIs were particularly noted among urban boys. In spite of having higher NKS, urban learners still appeared to have a high consumption frequency of high fat foods, which may be reflected in their nutritional status. Results indicated that urban learners were more likely to bring meals to school that were prepared at home, whereas peri-urban learners reportedly consumed more foods prepared outside of the home. It is possible that due to having a higher SES, urban learners may be in a position to consume more unhealthy foods within the home; as results showed a higher consumption of white bread, red meat and other processed meats. Also as the media influence on fast food purchases may be greater in some high-income areas due to higher purchasing power, urban learners may be exposed to obesogenic environments outside the home as well, as indicated by their higher consumption of fizzy drinks; thus placing them at risk of obesity and developing NCDs in later years. Such a group can benefit from an intervention such as nutrition education programs within the school setting; however education should not simply take the form of providing information, as learners with higher NKS in the urban school still reported poor eating habits and a notable overweight/obesity prevalence. Also parental

involvement in such an intervention may prove beneficial to urban learners, as it appears that an obesogenic environment may also be present within the household.

A similar nutritional status was noted among both urban and peri-urban girls, with the main difference being the stunting prevalence. Among girls in both groups, overweight/obesity was prevalent; however stunting was also prevalent among the peri-urban girls, unlike in the urban girls where it was nearly absent. Peri-urban boys also showed a high prevalence of stunting and a low prevalence of overweight/obesity, in contrast to urban boys.

Thus, results from this study revealed a notable prevalence of both overweight/obesity and stunting in peri-urban learners, indicating the presence of a double-burden. One grade 11 peri-urban girl was reported as both stunted and overweight. To date there has been little data that highlights the coexistence of stunting and overweight/obesity among South African adolescents. This double burden particularly among girls reflects a possibly higher risk of malnutrition-related issues such as pregnancy complications, as well as the development of communicable and NCDs in adulthood (Black *et al*., 2013; Rah *et al*., 2008).

Household food insecurity is largely associated with malnutrition, which encompasses both undernutrition and obesity. The stunting observed among the peri-urban learners was clearly reflective of their household food insecurity, which results revealed to be significantly higher and thus particularly vulnerable to the nutrient deficiencies that lead to stunting. Also, with what little purchasing power available to them, peri-urban learners may be more likely to consume cheap energy-dense foods in order to satisfy their hunger, such as deep-fried fatty snacks (vetkoeks, samosas). This might explain the prevalence of overweight/obesity among girls, as peri-urban learners can also be exposed to obesogenic environments, albeit of a different kind.

Thus, peri-urban learners can benefit from the improved availability of healthier foods and snack options. Tuck shop managers in South Africa share a general opinion that stocking

healthier items such as fruit beverages as opposed to fizzy drinks was not cost effective (Wiles *et al.,* 2011). Hence in such an instance, government initiatives to reduce the cost of healthier snack options can be beneficial. The National School Nutrition Programme (NSNP), which is a South African government initiative, was set up in 1994 to provide school children with a daily nutritious meal (NSNP, 2009). The programme was extended to secondary schools in October 2008 with the aim of fulfilling at least 30% of the daily nutritional needs of learners with each meal. At the time of data collection, the NSNP was active in the peri-urban school, however was in need of more community support. This may include the promotion of school gardens that learners, parents and the community at large can participate in and benefit from. There was sufficient space at the peri-urban school for a food garden and the principal expressed interest in constructing one. A nutrition education programme attached to this initiative can prove beneficial to both learners and parents, by providing information on the functional links between nutrition and health.

Levels of nutrition knowledge were significantly lower among peri-urban learners compared to urban learners. This may be reflective of the disparity in parental education, particularly in the education level of mothers, which appeared to be a significant factor in the outcome of NKS of both adolescent groups. Adolescents with mothers educated up to tertiary level scored higher in the nutrition knowledge questionnaire. This indicates that mothers may play a role in providing learners with nutritional knowledge, which is plausible given that mothers are usually in control of household food purchasing and preparation.

Thus a nutrition intervention targeted at mothers with the aim of promoting changes in dietary behaviour of adolescents in the household may be feasible. This would however, have to be aimed at early to mid- adolescence, as older adolescents may have already formed independent dietary habits outside of the home (Coovadia, 2009).

Whilst nutrition education is not commonplace in South African high schools, the national curriculum does include a subject referred to as Life Orientation, which is compulsory for grades 10 to 12. Life Orientation aims to equip learners with the necessary skills and knowledge needed to make better decisions regarding their health and their environment (Jacobs, 2011). For example, in grade 11 the Life Orientation subject consists of the topic "development of self in society", which involves assessing the role of nutrition in health and physical activities (Department of Education (DoE), 2003). Nutrition intervention aimed at improving the knowledge of educators may thus prove beneficial to learners, as educators can influence learners to make healthy food choices (Oldewage-Theron and Egal, 2012).

Although apparently evident that SES contributed to the outcome of NKS, the study posed the question: Even if nutrition knowledge was higher among peri-urban learners, would that translate to the consumption of healthier foods and a better nutritional status, given household food insecurity remained high? It has already been shown that high NKS did not translate into better eating habits among urban learners, just different ones. The reduced prevalence of stunting observed in urban learners was much more likely attributed to a higher SES and household food security than a better NKS. The results also indicated that the disparity in NKS between the urban and peri-urban school was related to SES as opposed to ethnicity or cultural differences, as many Black and non-White learners scored higher than White learners in the urban school.

Research in health behaviour has shown that dietary interventions are most effective when behaviour change theories such as the theory of planned behaviour (TPB) are incorporated into the theoretical framework (Hackman and Knowlden, 2014). Such theories can provide evidence-based methods that have been empirically tested with proven efficacy in facilitating changes in health-related behaviour (Hackman and Knowlden, 2014). Thus, it would be

worthwhile to further investigate the applicability and incorporation of such of behaviour change theories into the development of a nutrition intervention programme aimed at addressing adolescent dietary behaviour.

REFERENCES

1. Adeboye B, Bermano G, Rolland C (2012) Obesity and its health impact in Africa: a systematic review Cardiovas J Afr; 23(9):512-21. doi: 10.5830/CVJA-2012-040.
2. Alemayehu T, Haidar J, Habte D (2010) Adolescents' undernutrition and its determinants among in-school communities of Ambo town, West Oromia, Ethiopia. East Afr J Public Health;7(3):263-7.
3. Altman M, Hart TGB, Jacobs PT (2009) Household food security status in South Africa. Agrekon Journal, 48(4): 345-361
4. Amuna P, Zotor FB (2008) Epidemiological and nutrition transition in developing countries: impact on human health and development. Proc Nutr Soc, 67, 82–90
5. Aounallah-Skhiri H, Traissac P, El Ati J, Eymard-Duvernay S, Landais E, Achour N, Delpeuch F, Romdhane HB, Maire B (2011) Nutrition transition among adolescents of a south-Mediterranean country: dietary patterns, association with socio-economic factors, overweight and blood pressure A cross-sectional study in Tunisia. Nutr J, 10:38 http://www.nutritionj.com/content/10/1/38
6. Banerjee S, Dias A, Shinkre R, Patel V (2011) Under-nutrition among adolescents: A survey in five secondary schools in rural Goa. Natl Med J India;24:8–11
7. Bargiota A, Pelekanou M, Tsitouras A, Koukoulis, GN (2013) Eating habits and factors affecting food choice of adolescents living in rural areas. Horm. Athens Greece *12*, 246–253.
8. Barriguete-Meléndez JA, Unikel-Santoncini C, Aguilar-Salinas C, Córdoba-Villalobos JA, Shamah T, Barquera SD, Rivera JA, Hernández-Ávila M (2009) Prevalence of abnormal eating behaviours in adolescents in Mexico (Mexican

National Health and Nutrition Survey 2006) Salud Publica Mex;51 suppl 4:S638-S644.

9. Beghin L, Dauchet L, De Vriend T, Cuenca-Garcıa M, Manios Y, Toti E, Plada M, Widhalm K, Repasy J, Huybrechts I, Kersting M, Moreno LA, Dallongeville J. (2013) Influence of parental socio-economic status on diet quality of European adolescents: results from the HELENA study. BJN; 1-10.
10. Bhattarai MD (2012) Epidemic of non-communicable diseases and its control. Kathmandu Univ Med J. 10:2,38
11. Bhutta ZA and RA Salam. (2013) Global nutrition epidemiology and trends. Ann Nutr Metab; 61: 19-27
12. Belachew T, Lindstrom D, Gebremariam A, Jira C, Hattori MK, Lachat C, Huybregts L, Kolsteren P (2012) Predictors of chronic food insecurity among adolescents in Southwest Ethiopia: a longitudinal study. BMC Public Health , 12:604; http://www.biomedcentral.com/1471-2458/12/604
13. Belachew T, Hadley C, Lindstrom D, Gebremariam A, Michael KW, Getachew Y, Lachat C, Kolsteren P (2011a) Gender Differences in Food Insecurity and Morbidity Among Adolescents in Southwest Ethiopia. Pediatrics; 127, 2, 398-405
14. Belachew T, Hadley C, Lindstrom D, Gebremariam A, Lachat C, Kolsteren P (2011b) Food insecurity, school absenteeism and educational attainment of adolescent s in Jimma Zone SouthwestEthiopia: a longitudinal study. Nutr J; 10:29.
15. Bell RA, Cassady D, Culp J. (2009) Frequency and Types of Foods Advertised on Saturday Morning and Weekday Afternoon English- and Spanish-Language American Television Programs. J Nutr Ed Behav; 41(6), 406-413

16. Black RE, Victoria CG, Walker SP, Bhutta Z, Christian P, de Onis, Ezzati M, Grantham-McGregor S, Katz J, Marorel R, Uauy R (2013) Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet; 382: 427–51 http://dx.doi.org/10.1016/S0140-6736(13)60937-X
17. Bloom DE, Cafiero, ET, Jané-Llopis E, Abrahams-Gessel S, Bloom LR, Fathima S, Feigl AB, Gaziano T, Mowafi M, Pandya A, Prettner K, Rosenberg L, Seligman B, Stein AZ, Weinstein C. (2011).The Global Economic Burden of Noncommunicable Diseases. Geneva: World Economic Forum. Available from: http://www3.weforum.org/docs/WEF_Harvard_HE_GlobalEconomicBurdenNonCommunicableDiseases_2011.pdf
18. Boutayeb A, Boutayeb S (2005) The burden of non-communicable diseases in developing countries. Int J Equity Health, 4:2
19. Branson N, Ardington C, Lam D, et al. (2013) Changes in education, employment and earnings in South Africa – A cohort analysis. A Southern Africa Labour and Development Research Unit Working Paper Number 105. Cape Town: SALDRU, University of Cape Town. Available from: http://hdl.handle.net/11090/621
20. Bygbjerg IC (2012) Double Burden of Non-communicable and Infectious Diseases in Developing Countries. Science 337, 1499
21. Caprio S. (2012) Development of type 2 diabetes mellitus in the obese adolescent: a growing challenge. Endocr Pract. 18(5):791-5.
22. Chang SM, Walker SP, Grantham-McGregor, Powell CA (2002); Early childhood stunting and later behaviour and school achievement. *J. Child Psychol. Psych.* 43 (6) 775-783.

23. Chaparro M, Zaghloul S, Holck P, Dobbs J (2009) Food insecurity prevalence among college students at the University of Hawai'i at Ma¯noa; Public Health Nutr: 12(11), 2097–2103
24. Coates J, Swindale A, Bilinsk P. (2007) Household Food Insecurity Access Scale (HFIAS) for measurement of food access: Indicator guide, version 3; Washington: Food and Nutrition Technical Assistance Project, Academy for Educational Development.
25. Coovadia W (2009) Coovadia's Pediatrics and Child Health (6th Ed). Southern Africa: Oxford University Press
26. Cordeiro LS, Wilde PE, Semu H, Levinson FJ (2012) Household food security is inversely associated with undernutrition among adolescents from Kilosa, Tanzania. J Nutr; 142(9):1741-7.
27. Dapi ln, Janlert U, Nouedoui C, Stenlund H, Håglin L (2009). Socioeconomic and gender differences in adolescents' nutritional status in urban Cameroon, Africa. Nutr Res 29, 313–319
28. Dapi LN, Nouedoui C, Urban Janlert U, Haglin L (2005) Adolescents' food habits and nutritional status in urban and rural areas in Cameroon, Africa. Scand J Nutr; 49 (4): 151-158
29. De Cock N, D'Haese M, Vink N, van Rooyen CJ, Staelens L, Schönfeldt HC, D'Haese L. (2013) Food security in rural areas of Limpopo province, South Africa. Food Sec; 5:269–282
30. Dekker LH, Mora-Plazas M, Marín C, Baylin A, Villamor E. (2010) Stunting associated with poor socioeconomic and maternal nutrition status and respiratory morbidity in Colombian schoolchildren. Food Nutr Bull 31(2): 242-250.

31. Delisle HF. (2008) Poverty: the double burden of malnutrition in mothers and the intergenerational impact. Ann N Y; Acad Sci; 1136: 172-84.
32. Department of Education (2004). National Norms and Standards for School Funding. Proposals for amendments. Department of Education, Pretoria. Available from: http://www.education.gov.za/LinkClick.aspx?fileticket=Ik0KC8mvL5c%3D&tabid=187&mid=482
33. Dolman RC, Wentzel-Viljoen E, Jerling JC, Feskens EJ, Kruger A, Pieters M (2013) The use of predefined diet quality scores in the context of CVD risk during urbanization in the South AfricanProspective Urban and Rural Epidemiological (PURE) study. Public Health Nutr; 17(8):1706-16.
34. Ejaz MS, Latif N (2010) Stunting and micronutrient deficiencies in malnourished children. JPMA; 60:543.
35. Filippi, AR, Amodio, E, Napoli, G, Breda, J, Bianco, A, Jemni, M, Censi, L, Mammina, C, and Tabacchi, G. (2014). The web-based ASSO-food frequency questionnaire for adolescents: relative and absolute reproducibility assessment. Nutr. J. *13*, 119.
36. Gandy J (Ed) (2014) Manual of Dietetic Practice (5th Ed). United Kingdom: Wiley-Blackwell on behalf of the British Dietetic Association
37. Garcia S, Sarmiento OL, Forde I, Velasco T (2012) Socio-economic inequalities in malnutrition among children and adolescents in Colombia: the role of individual-, household- and community-level characteristics Public Health Nutr: 1 -16
38. Gibbs CM, Wendt A, Peters S, Hogue CJ. (2012) The Impact of Early Age at First Childbirth on Maternal and Infant Health. Paediatr Perinat Epidemiol;26:259–84.

39. Ginsburg C, Griffiths PL, Richter LM, Norris SA (2013) Residential mobility, socioeconomic context and body mass index in a cohort of urban South African adolescents. Health & Place 19; 99–107

40. Goh YY, Bogart LM, Sipple-Asher BK, Uyeda K, Hawes-Dawson J, Olarita-Dhungana J,Ryan GW, Schuster MA. (2009) Using community-based participatory research to identify potential interventions to overcome barriers to adolescents' healthy eating and physical activity. J Behav Med; 32:5, 491–502.

41. Grace College Outreach Programme. Available from: http://www.grace-college.co.za/about-us/outreach/masihambisane

42. Grosso G, Mistretta A, Turconi G, Cena H,Roggi C, Galvano F (2012) Nutrition knowledge and other determinants of food intake and lifestyle habits in children and young adolescents living in a rural area of Sicily, South Italy Public Health Nutr: 1-10

43. Grotto D, Zied E (2010) The Standard American Diet and its relationship to the health status of Americans. Nutr Clin Pract; 25(6):603-12

Bargiota, A., Pelekanou, M., Tsitouras, A., and Koukoulis, G.N. (2013). Eating habits and factors affecting food choice of adolescents living in rural areas. Horm. Athens Greece *12*, 246–253.

Van Der Merwe, M.-T., and Pepper, M.S. (2006). Obesity in South Africa. Obes. Rev. *7*, 315–322.

Filippi, A.R., Amodio, E., Napoli, G., Breda, J., Bianco, A., Jemni, M., Censi, L., Mammina, C., and Tabacchi, G. (2014). The web-based ASSO-food frequency questionnaire for adolescents: relative and absolute reproducibility assessment. Nutr. J. *13*, 119.

Hackman, C.L., and Knowlden, A.P. (2014). Theory of reasoned action and theory of planned behavior-based dietary interventions in adolescents and young adults: a systematic review. Adolesc. Health Med. Ther. *5*, 101–114.

Oldewage-Theron, W., Egal, A., and Moroka, T. (2014). Nutrition Knowledge and Dietary Intake of Adolescents in Cofimvaba, Eastern Cape, South Africa. Ecol. Food Nutr. *0*, 1–19.

Sedibe, H.M., Kahn, K., Edin, K., Gitau, T., Ivarsson, A., and Norris, S.A. (2014). Qualitative study exploring healthy eating practices and physical activity among adolescent girls in rural South Africa. BMC Pediatr. *14*, 211.

Swinburn, B.A., Sacks, G., Hall, K.D., McPherson, K., Finegood, D.T., Moodie, M.L., and Gortmaker, S.L. (2011). The global obesity pandemic: shaped by global drivers and local environments. The Lancet *378*, 804–814.

Hadley C, Lindstrom D, Tessema F, Belachew T. Gender Bias in the Food Insecurity Experience of Ethiopian Adolescents. Soc Sci Med 2008; 66:2; 427–438.

44. Hanson MD, Chen E. Socioeconomic status and health behaviours in adolescence: A review of the literature (2007); J Behav Med; 30: 263–285.
45. Hardy LL, Grunseit A, Khambalia A, Bell C, Wolfenden L, Milat AJ (2012) Co-occurrence of obesogenic risk factors among adolescents. J Adolesc Health; 51(3):265-71.
46. Healy M. (2014) U.N. food chief: Obesity, unhealthy diets a greater threat than tobacco. LA Times, May 19th 2014. Available from: http://www.latimes.com/science/la-sci-sn-united-nations-obesity-20140519-story.html
47. Hoffmann K, Bryl W, Marcinkowski JT, Rzesoś A, Wojtyła E, Pupek-Musialik D (2012) Dietary behaviours of adolescents from urban and rural areas in the district of Szamotuły--a preliminary study. Ann Agric Environ Med; 19(1):103-7.
48. Jacobs PT. (2009) The status of household food security targets in South Africa. Agrekon; 48:4; 410–433.
49. Jansen, JD. (2004) Race and education after ten years. PiE, 22(4), 117-128.
50. Jinabhai CC, Taylor M, Reddy P, Monyeki D, Kamabaran N, Omardien R, Sullivan KR (2007) Sex differences in under and over nutrition among school-going Black teenagers in South Africa: an uneven nutrition trajectory. Trop Med Int Health; 12;(8):944–952.

51. Jyoti D, Frongillo EAJ, Jones S. (2005) Food insecurity affects school children's academic performance, weight gain, and social skills. J Nutr; 135: 2831–2839.
52. Kac G, Velásquez-Melendez G, Schlüssel MM, Segall-Côrrea AM, Silva AA, Pérez-Escamilla R. (2012) Severe food insecurity is associated with obesity among Brazilian adolescent females. Public Health Nutr;15 (10):1854-60.
53. Kahn K (2011) Population health in South Africa: Dynamics over the past two decades. J Public Health Policy. 32**,** 30–36.
54. Kassier, SM. Baseline descriptors, intervention outcome and evaluation thereof in overweight/obese treatment seeking Zulu women enrolled in a healthy weight loss intervention. University of Cape Town: Cape Town 2014; (unpublished PhD dissertation).
55. Khoury CK, Bjorkman AD, Dempewolf H, Ramirez-Villegas J, Guarino L, Jarvis A, Rieseberg LH, Struik PC. (2014). Increasing homogeneity in global food supplies and the implications for food security. Proc Natl Acad Sci USA; 111(11):4001-6.
56. Kimani-Murage EW (2013) Exploring the paradox: double burden of malnutrition in rural South Africa. Glob Health Action; 6: 19249
57. Kimani-Murage EW, Kahn K, Pettifor JM, Tollman SM, Klipstein-Grobusch K, Norris SA. (2011) Predictors of adolescent weight status and central obesity in rural South Africa. Public Health Nutr. 14(6):1114-22.
58. Kimani-Murage EW, Kahn K, Pettifor JM, Tollman SM, Dunger DB, Gómez-Olivé XF, Norris SA (2010) The prevalence of stunting, overweight and obesity, and metabolic disease risk in rural South African children; BMC Public Health, 10:158
59. Korkalo L, Freese R, Fidalgo L, Selvester K, Ismael C, Mutanen M (2014) A Cross-Sectional Study on the Diet and Nutritional Status of Adolescent Girls in Zambézia

Province, Mozambique (the ZANE Study): Design, Methods, and Population Characteristics. JMIR Res Protoc; 5;3(1):e12.

60. Krawinkel MB (2012) Overcoming undernutrition with local resources in Africa, Asia and Latin America. J Sci Food Agric; 92: 2757–2759
61. Kruger R, Kruger HS, MacIntyre UE (2005) The determinants of overweight and obesity among 10- to 15-year-old schoolchildren in the North West Province, South Africa– the THUSA BANA (Transition and Health during Urbanisation of South Africans; BANA, children) study Public Health Nutr: 9(3), 351–358 DOI: 10.1079/PHN2005849
62. Labadarios D (2008) Executive summary of the National Food Consumption Survey Fortification Baseline (NFCS-FB-I) South Africa, 2005. S Afr J Clin Nutr;21(3)(Suppl 2):245-300
63. Leal VS, de Lira PIC, de Menezes RCE, Oliveira JS, de Souza LA, de Andrade SL, and MB Filho. Factors associated with the decline in stunting among children and adolescents in Pernambuco, Northeastern Brazil. Rev Saúde Pública. 2012; 46(2)
64. Letlape SV, Mokwena K, Oguntibeju OO (2010) Knowledge of Students Attending a High School in Pretoria, South Africa, on Diet, Nutrition and Exercise. West Indian Med J; 59 (6): 633
65. Lock K, Smith RD, Dangour AD, Keogh-Brown M, Pigatto G, Hawkes C, Fisberg RM, and Z Chalabi. (2010) Health, agricultural, and economic effects of adoption of healthy diet recommendations. Lancet. 376(9753): 1699-709.
66. Lopez, AD, Mathers, CD, Ezzati M (2006) Global Burden of Disease and Risk Factors. World Bank. Washington, DC.

67. *Love P, Maunder EMW, Green JM (2008)* Are South African women willing and able to apply the new Food-Based Dietary Guidelines? Lessons for nutrition educators. S Afr J Clin Nutr; 21, 2; 17-24
68. Lule, E, Rosen J (2006) Adolescent health programs: in Disease Control Priorities in Developing Countries, ed. D. T. Jamison et al. Washington, D.C World Bank; Oxford, UK: Oxford University Press.
69. Mayosi, BM, Flisher, AJ, Lalloo UG, Sitas F, Tollman SM, Bradshaw D. (2009) The burden of non-communicable diseases in South Africa. Lancet; 374**:** 934–947.
70. McArthur L, Pen˜a M, Holbert D (2001) Effects of socioeconomic status on the obesity knowledge of adolescents from six Latin American cities. Int J Obes. 25, 1262–1268
71. Mesías M, Seiquer I, Navarro MP (2013) Iron Nutrition in Adolescence, Critical Reviews in Food Science and Nutrition, 53:11, 1226-1237
72. Mesías M, Seiquer I, Navarro MP (2011) Calcium Nutrition in Adolescence, Critical Reviews in Food Science and Nutrition, 51:3, 195-209
73. More S, Shivkumar VB, Gangane N, Shende S. (2013) Effects of Iron Deficiency on Cognitive Function in School Going Adolescent Females in Rural Area of Central India. Anemia 2013. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3872396/
74. Mouton N, Louw GP, Strydom GL (2012) A historical analysis of the post-Apartheid dispensation of education in South Africa (1994-2011). IBER. **11**: 11
75. Murtin, F (2013) Improving Education Quality in South Africa. OECD Economics Department Working Papers.; No. 1056. OECD Publishing. Available from: http://dx.doi.org/10.1787/5k452klfn9ls-en

76. Nackers LM, Appelhans BM (2013) Food Insecurity Is Linked to a Food Environment Promoting Obesity in Households With Children. J Nutr Educ Behav;45:780-784

77. Naghavi M, Forouzanfar MH. (2013)Burden of non-communicable diseases in sub-Saharan Africa in 1990 and 2010: Global Burden of Diseases, Injuries, and Risk Factors Study 2010. Lancet; 381, S95

78. Ng M, Fleming T, Robinson M. Et al. (2014) Global, regional, and national prevalence of overweight and obesity in children and adults during 1980—2013: a systematic analysis for the Global Burden of Disease Study 2013.Lancet (Early Online Publication), doi: 10.1016/S0140-6736(14)60460-8.

79. NSNP (2009) National School Nutrition Programme. A Guide for Secondary Schools. Department of Education. Available from: http://www.education.gov.za/LinkClick.aspx?fileticket=AzMOJpmC/dE%3D

80. Oldewage-Theron W, Egal A, Moroka T. (2014). Nutrition Knowledge and Dietary Intake of Adolescents in Cofimvaba, Eastern Cape, South Africa. Ecol. Food Nutr. *0*, 1–19.

81. Oldewage-Theron WH, Egal A. (2012) Impact of nutrition education on nutrition knowledge of public school educators in South Africa: A pilot study. Health SA Gesondheid 17(1)

82. Patton GC; Coffey C; Cappa C; Currie D; Riley L; Gore F; Degenhardt L; Richardson D; Astone N; Sangowawa AO; Mokdad A; Ferguson J (2012) Health of the world's adolescents: a synthesis of internationally comparable data. Lancet; 379: 1665–75

83. Pearson A, Jordan Z (2010) Evidence-based healthcare in developing countries. Int J Evid Based Healthc; 8: 97–100

84. Popkin BM, Adair LS, Ng SW. (2012) Global nutrition transition and the pandemic of obesity in developing countries. Nutr Rev; 70: 3-21.
85. Powell LM, Nguyen BT (*2013).* Fast-Food and Full-service Restaurant Consumption among Children and Adolescents: Impact on Energy, Beverage and Nutrient Intake. J Am Med Assoc *Ped;* 167:1; 14–20
86. Puoane T, Tsolekile L, Steyn N (2010) Perceptions about body image and sizes among Black African girls living in Cape Town. Ethn Dis; 20(1):29-34.
87. Rah JH, Christian P, Shamim AA, Arju UT, Labrique AB, Rashid M. (2008) Pregnancy and Lactation Hinder Growth and Nutritional Status of Adolescent Girls in Rural Bangladesh. J Nutr. 1;138(8):1505–11.
88. Ranjana S, Mahomoodally, FM, Ramasawmy D (2013) Is Healthy Eating Behaviour Common Among School Adolescents in Mauritius? Curr Nutr Food Sci; 1(1), 11-22.
89. Raschke V, Cheema B. Colonisation, the New World Order, and the eradication of traditional food habits in East Africa: historical perspective on the nutrition transition. Public Health Nutr 2007; 11:7, 662–674.
90. Reddy SP, Resnicow K, James S, Kambaran N, Omardien R, MBewu AD (2009) Underweight, overweight and obesity among South African adolescents: results of the 2002 National Youth Risk Behaviour Survey Public Health Nutr: 12(2), 203–207.
91. Reddy SP, Panday S, Swart D, Jinabhai CC, Amosun SL, James S (2003) The South African Youth Risk Behaviour Survey 2002. Cape Town: South African Medical Research Council.
92. Rodríguez-Ramírez S, Mundo-Rosas V, Shamah-Levy T, Ponce-Martínez X, Jiménez-Aguilar A, González-de Cossío T (2009) Energy and nutrient intake in

Mexican adolescents: Analysis of the Mexican National Health and Nutrition Survey 2006. Salud Publica Mex; 51 suppl 4:S551-S561.

93. Roohani N, Hurrell R, Kelishadi R, Schulin R (2013) Zinc and its importance for human health: An integrative review. J Res Med Sci; 18(2): 144–157.
94. Rosenquist TH (2013) Folate, Homocysteine and the Cardiac Neural Crest. Dev Dyn; 242:201–218.
95. Rossouw HA, Grant CC, Viljoen M (2012) Overweight and obesity in children and adolescents: The South African problem. S Afr J Sci; 108(5/6)
96. Rouhani MH, Mirseifinezhad M, Omrani N, Esmaillzadeh A, Azadbakht L. (2012) Fast food consumption, quality of diet, and obesity among Isfahanian adolescent girls. J Obes; Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3352603/
97. Schaible UE, Kaufmann SHE (2007) Malnutrition and infection: Complex mechanisms and global impacts. Plos Med 4(5): e115.
98. Schram A, Labonté R, Sanders D (2013) Urbanization and international trade and investment policies as determinants of noncommunicable diseases in Sub-Saharan Africa. Prog Cardiovasc Dis; 56,3:281-301
99. Scully M, Wakefield M, Niven P, Chapman K, Crawford D, Pratt IS, Baur LA, Flood V, Morley B (2012) Association between food marketing exposure and adolescents' food choices and eating behaviors. Appetite; 58(1):1-5.Sedibe MH, Griffiths PL, Doak CM, Feeley AB, Voorend C, Norris SA (2014) Narratives of urban female adolescents in South Africa: dietary and physical activity practices in an obesogenic environment. S Afr J Clin Nutr.

100. Sedibe MH, Kahn K., Edin K, Gitau T, Ivarsson A, Norris SA (2014) Qualitative study exploring healthy eating practices and physical activity among adolescent girls in rural South Africa. BMC Pediatr. *14*, 211.

101. Sharieff W, (2008); Economics of preventing premature mortality and impaired cognitive development in children through home-fortification: A health policy perspective; Int J Technol Assess Health Care, 24:3; 303–311.

102. Shetty P (2013) Nutrition transition and its health outcomes. Indian J Pediatr. 80: 1;21–27.

103. Shisana O, Labadarios D, Rehle T, Simbayi L, Zuma K, Dhansay A, Reddy P, Parker W, Hoosain E, Naidoo P, Hongoro C, Mchiza Z, Steyn NP, Dwane N, Makoae M, Maluleke T, Ramlagan S, Zungu N, Evans MG, Jacobs L, Faber M, & SANHANES-1 Team. (2013) South African National Health and Nutrition Examination Survey (SANHANES-1); Cape Town: HSRC Press. Available from: http://www.hsrc.ac.za/en/research-outputs/view/6493

104. Soares NN, Mattar R, Camano L, Torloni MR (2010) Iron deficiency anemia and iron stores in adult and adolescent women in pregnancy. Acta Obstet Gynecol; 89: 343–349

105. Spaull, N (2013) Poverty and Privilege: primary school inequality in South Africa, Intl J Ed Dev. 33:5, 436–447

106. SPSS Inc. Released (2010). PASW Statistics for Windows, Version 19.0. Chicago: SPSS Inc.

107. Stevens A, Begum G, White A (2011) Epigenetic changes in the hypothalamic pro-opiomelanocortin gene: A mechanism linking maternal undernutrition to obesity in the offspring? Eur J Pharmacol; 660; 194–201.

108. Steyn NP, Bradshaw D, Norman R, Joubert JD, Schneider M, Steyn K. (2006) Dietary Changes and the Health Transition in South Africa: Implications for Health Policy. Cape Town: South African Medical Research Council,. Available from: http://www.fao.org/docrep/009/a0442e/a0442e0v.htm

109. Story M, French S (2004) Food advertising and marketing directed at children and adolescents in the US. International J Behav Nutr Phys Activ; 1:3

110. Stupar D, Eide WB, Bourne L, Hendricks M, Iversen PO, Wandel M (2012) The nutrition transition and the human right to adequate food for adolescents in the Cape Town metropolitan area: Implications for nutrition policy Food Policy; 37; 199–206

111. Swinburn, BA, Sacks, G, Hall, K.D, McPherson, K, Finegood, DT, Moodie, ML, Gortmaker, SL, (2011). The global obesity pandemic: shaped by global drivers and local environments. Lancet 378, 804–814.

112. Tathiah N, Moodley I, Mubaiwa V, Denny, L. (2013) South Africa's nutritional transition: Overweight, obesity, underweight and stunting in female primary school learners in rural KwaZulu-Natal, South Africa. S Afr Med J.; 103(10): 718-723

113. Temple NJ, Steyn NP, (2011) The cost of a healthy diet: A South African perspective; Nutr; 27; 505–508

114. Temple NJ, Steyn NP, Fourie J, De Villiers A. (2010) Price and availability of healthy food: a study in rural South Africa. Nutr; 26 (in press).

115. Temple NJ, Steyn NP, Myburgh NG, Nel JH. (2006) Food items consumed by students attending schools in different socioeconomic areas in Cape Town, South Africa. Nutr; 22: 252–258

116. Thorne-Lyman AL, Valpiani N, Sun K, Semba RD, Klotz CL, Kraemer K, Akhter N, de Pee S, Moench-Pfanner R, Sari M, Bloem MW (2006) Household dietary diversity and food expenditures are closely linked in rural Bangladesh, increasing the risk of malnutrition due to the financial crisis. J Nutr; 140:1;182S-8S.

117. Thurlow J, Gow J, George G (2009) HIV/AIDS, growth and poverty in KwaZulu-Natal and South Africa: an integrated survey, demographic and economy-wide analysis. J Int AIDS Soc;12:18.

118. Trentmann C. (2012) Supplementation, food fortification and dietary diversification: A three-pronged approach to reducing hidden hunger. Federal Ministry for Economic Cooperation and Development (BMZ), Available from: http://www.bmz.de/en/zentrales_downloadarchiv/themen_und_schwerpunkte/ernaehrung/food_fortification.pdf

119. Uauy R, Garmendia ML, Corvalán, C. (2014) Addressing the double burden of malnutrition with a common agenda. Nestle Nutr Inst Workshop Ser.; 78: 39-52.

120. UNICEF (2012) Progress for Children: A report card on adolescents. United Nations Children's Fund. Available from: http://www.unicef.org/media/files/PFC2012_A_report_card_on_adolescents.pdf

121. UNICEF (2013) Nutrition training: Adolescents. Available from: http://www.unicef.org/nutrition/training/3.3/6.html

122. United Nations Population Fund (UNFPA) (2012) Adolescents and Young people in Sub-Saharan Africa: opportunities and challenges: Available from: http://www.prb.org/pdf12/status-report-youth-subsaharan-Africa.pdf

123. Utter J, Scragg R, Mhurchu CN, Schaaf D (2007) What effect do attempts to lose weight have on the observed relationship between nutrition behaviors and body mass index among adolescents? Int J Behav Nutr Phys Act, 19, 4:40

124. Van der Berg, S (2009) The persistence of inequalities in education: In Aron, J, Kahn, B, Kingdon G South African Economic Policy under Democracy; 327-. Oxford University Press, Oxford.

125. Van Der Merwe, MT, and Pepper, MS. (2006). Obesity in South Africa. Obes. Rev. *7*, 315–322.

126. Voorend CG, Norris SA, Griffiths PL, Sedibe MH, Westerman MJ, Doak CM. (2013) 'We eat together; today she buys, tomorrow I will buy the food': adolescent best friends' food choices and dietary practices in Soweto, South Africa. Public Health Nutr; 16(3):559-67.

127. *Vorster HH, Badham JB, Venter CS (2013)* An introduction to the revised food-based dietary guidelines for South Africa. S Afr J Clin Nutr; 26(3) (Supp):S5-S12

128. Wall MM, Larson NI, Forsyth A, Van Riper DC, Graham DJ, Story MT, Neumark-Sztainer D

(2012) Patterns of obesogenic neighborhood features and adolescent weight:

a comparison of statistical approaches. Am J Prev Med; 42(5):e65-75.

129. Wang Y, Chen X (2011) How much of racial/ethnic disparities in dietary intakes, exercise, and weight status can be explained by nutrition- and health-related psychosocial factors and socioeconomic status among US adults? J Am Diet Assoc. 111,1904-191

130. Wessells KR, Brown KH (2012) Estimating the Global Prevalence of Zinc Deficiency: Results Based on Zinc Availability in National Food Supplies and the Prevalence of Stunting. PLoS ONE 7(11): e50568.

131. Whati LH, Senekal M, Steyn NP, et al. (2005) Development of a reliable and valid nutritional knowledge questionnaire for urban South African adolescents. Nutr. 21**,** 76–85

132. WHO (2013a) Obesity and overweight. World Health Organisation Media Centre; Fact sheet No.311. Available from http://www.who.int/mediacentre/factsheets/fs311/en/index.html

133. WHO (2013b) Noncommunicable diseases. World Health Organisation Media Centre; Fact sheet No 355. Available from http://www.who.int/mediacentre/factsheets/fs355/en/index.html

134. WHO (2010) World Health Organisation. Global status report on non-communicable diseases. Available from: http://www.who.int/nmh/publications/ncd_report_full_en.pdf.

135. WHO (2005) Nutrition in adolescence: issues and challenges for the health sector: issues in adolescent health and development. World Health Organization. Available from: http://whqlibdoc.who.int/publications/2005/9241593660_eng.pdf

136. Wiles NL, Green JM, Veldman FJ. (2011) The variety, popularity and nutritional quality of tuck shop items available for sale to primary school learners in Pietermaritzburg, South Africa. S Afr J Clin Nutr; 24:3;129-135Willan S (2013) A Review of Teenage Pregnancy in South Africa. Partners in Sexual Health. Available from: http://www.rmchsa.org/wp-content/uploads/2013/08/Teenage-Pregnancy-in-South-Africa-2013.pdf

137. Williams S (2013) Action needed to combat food and drink companies' social media marketing to adolescents. Perspect Public Health;133(3):146-7

138. Wojtyła-Buciora P, Stawińska-Witoszyńska B, Klimberg A, Wojtyła A, Goździewska M, Wojtyła K, Piątek J, Wojtyła C, Sygit M, Ignyś I, Marcinkowski JT (2013) Nutrition-related health behaviours and prevalence of overweight and obesity among Polish children and adolescents Ann Agric Environ Med, 20(2) 332–340

139. Yoon J, Lyu E, Lee K (2008) Korean adolescents' perceptions of nutrition and health towards fast foods in Busan area. Nutr Res Prac, 2(3), 171-177

140. Zingoni C, Norris SA, Griffiths PL, Cameron N (2009) Studying a population undergoing nutrition transition: a practical case study of dietary assessment in urban South African adolescents. Ecol Food Nutr; 48(3): 178–198. doi:10.1080/03670240902794713

APPENDIX

Nutrition knowledge, food security status and dietary diversity of adolescents attending an urban and a peri-urban secondary school

Keiron Audain (PhD candidate)

Discipline of Dietetics & Human Nutrition

1. Date: ____/____/____ (Day/Month/Year)

2. Study Identification No. _ _ _ - _ _ _ _ - _ _ _

Race	Black	White	Coloured	Indian
(please tick)				

Date of Birth……

Grade	**9**	**10**	**11**
Please tick			

Anthropometric Assessment

	Weight (kilograms to two decimal places)	**Height (metres to three decimal places)**	**Mid-upper arm circumference (MUAC) [predominant arm] (centimetres to one decimal place)**	**Body Mass Index (BMI) (kilograms per square metre)**
Measurement 1				
Measurement 2				
Average				

A. NUTRITION KNOWLEDGE QUESTIONNAIRE

(please circle the correct answer)

1. **You should eat a lot of sugar to have enough energy** TRUE/FALSE

2. **What a pregnant woman eats during pregnancy has no effect on her health and the health of her unborn baby** TRUE/FALSE

3. **You should not have starches at most meals because**:

a) They are not important for your health

b) Even eating small amounts can cause weight gain

c) They cause diseases

d) None of the above

4. **How much water should you drink a day?**

a) You don't have to drink water everyday

b) 1 to 3 glasses

c) 4 to 6 glasses

d) 7 to 9 glasses

5. **You should add extra salt to your cooked food before you even eat it** TRUE/FALSE

6. **From which group of foods should you eat the most every day?**

a) Bread, samp, rice, porridge

b) Apples, bananas, spinach, carrots

c) Milk, yogurt, cheese

d) Chicken, fish, beans, eggs

7. **Which one of the following is not healthy for a pregnant woman to do?**

a) Be physically active

b) Eat different kinds of foods

c) Sleep most of the day

d) Drink lots of water

8. **People who are overweight should not be physically active** TRUE/FALSE

9. The healthiest snack is

a) A glass of milkshake

b) A tub of unbuttered popcorn

c) A slab of chocolate

d) 2 and 3 above

10. The key to a healthy way of eating is to:

a) Eat many different kinds of foods

b) Eat some foods more than other foods

c) Eat certain kinds of foods in moderate or small amounts

d) All of the above

11. The following foods must not be eaten at all when one is trying to lose weight

a) Bread and rice

b) Meat and fish

c) Margarine

d) None of the above

12. If you were trying to increase the amount of fibre in your diet, which one of the following foods should you eat more of?

a) Cakes and biscuits

b) Apples and carrots

c) Chips and pies

d) Chicken and fresh fish

13. Which of the following choice of foods prevent certain diseases?

a) Fish, Chicken without skin, and lean meat

b) Beef sausage, bacon, and lean mince

c) Fried fish, fried chicken, and regular mince

d) All of the above

14. Which foods contain a lot of fibre?

a) Oats, apples, beans

b) Milk, yoghurt, cheese

c) Beef, chicken, mutton

d) Butter, margarine

15. How many fruits and vegetables should be eaten?

a) 1 fruit and vegetable a day

b) 3-4 fruits and vegetables a day

c) 5 or more fruits and vegetables everyday

d) There is no need to eat fruits and vegetables daily

16. If you are eating a healthy diet there is no need for you to be physically active TRUE/FALSE

17. You can drink as much wine, beer, ciders as you want provided you have eaten first TRUE/FALSE

18. Your body only needs a little bit of salt to be healthy TRUE/FALSE

19. A well- balanced diet:

a) Consists mostly of meat, with smaller amounts of starch, fruits, vegetables, and dairy products

b) Consists mostly of vegetables, and smaller amounts of meat and dairy products

c) Consists mostly of starches, vegetables and fruits, with smaller amounts of meat and dairy products

d) None of the above

20. Sugar and foods that contain sugar should be eaten in small amounts: TRUE/FALSE

21. Eating a lot of different kinds of foods is healthier than eating only a few kinds of foods TRUE/FALSE

22. It is impossible to get *all* vitamins and minerals you need from food, you need to take a vitamin and mineral pill TRUE/FALSE

23. Overweight women should try to lose weight when they are pregnant TRUE/FALSE

24. Sugar contains a lot of vitamins and minerals TRUE/FALSE

25. Which one of the following groups of nutrients are found in large amounts in fruits and vegetables?

a) Fibre, Vitamin A

b) Starches, fat, Vitamin D

c) Fats, Iron, Calcium

d) None of the above

26. Which of the following breakfast menus contain little fat?

a) Whole-wheat toast with thinly spread margarine

b) Weet-a-Bix with 2% fat milk

c) Bacon and egg

d) a and b

27. It is important for a pregnant women to avoid eating different kinds of foods/; TRUE/FALSE

28. All water is safe to drink: TRUE/FALSE

29. Drinking boiled water is a good way to lose weight TRUE/FALSE

30. Eating bread always causes weight gain TRUE/FALSE

31. Which food has the most fibre?

a) White rolls

b) Brown bread

c) White bread

d) Whole wheat bread

32. To make sure that you stay healthy you should eat:

a) Lean meat, fruits and vegetables, low fat dairy products, and breads and cereals

b) Fruit and vegetables only

c) Bread, cereals, fruit and vegetables only

d) Low fat dairy products and lean meat only

33. Which of the following foods are the lowest in fat:

a) Corn flakes and full cream milk

b) Grilled lean steak and boiled carrots

c) Pizza and milkshake

d) Fried lamb chops and creamed spinach

34. Being physically active means:

a) Going to the gym

b) Walking a lot

c) Playing sports like soccer and netball

d) All of the above

35. **To protect yourself from disease you should avoid eating many different kinds of foods** TRUE/FALSE

36. **It is healthy to snack on foods that contain a lot of sugar** TRUE FALSE

37. **Which of the following should a pregnant woman eat more of?**

a) Milk, cheese, maas

b) Meat, chicken, fish

c) Fruits and vegetables

d) All of the above

38. **Which of the following is a low fat snack?**

a) "Samba" chips

b) Popcorn

c) Fried Chips

d) "Niknaks"

39. **Dry beans, peas, and lentils should be eaten often** TRUE/FALSE

40. **You can eat as much meat as you want every day:** TRUE/FALSE

41. **Dry beans, peas, lentils are a healthy choice to eat in place of meat:** TRUE/FALSE

42. **The reason why beans, peas and lentils are good for you is that**

a) They contain only small amounts of fat

b) They contain a lot of fibre

c) They can protect you from some diseases

d) All of the above

B. HOUSEHOLD FOOD INSECURITY ACCESS SCALE (HFIAS)

(please circle the correct answer)

1. **In the past four weeks, did you worry that you would not have enough food?**

- 0 = No (skip to Q2)
- 1=Yes

How often did this happen?

- 1 = Rarely (once or twice in the past four weeks)
- 2 = Sometimes (three to ten times in the past four weeks)
- 3 = Often (more than ten times in the past four weeks)

2. **In the past four weeks, were you not able to eat the kinds of foods you preferred because of a lack of money?**

- 0 = No (skip to Q3)
- 1=Yes

How often did this happen?

- 1 = Rarely (once or twice in the past four weeks)
- 2 = Sometimes (three to ten times in the past four weeks)
- 3 = Often (more than ten times in the past four weeks)

3. **In the past four weeks, did you have to eat a limited variety of foods due to a lack of money?**

- 0 = No (skip to Q4)
- 1 = Yes

How often did this happen?

- 1 = Rarely (once or twice in the past four weeks)
- 2 = Sometimes (three to ten times in the past four weeks)
- 3 = Often (more than ten times in the past four weeks)

4. **In the past four weeks, did you have to eat some foods that you really did not want to eat because of a lack of money to obtain any other types of food?**

- 0 = No (skip to Q5)
- 1 = Yes

How often did this happen?

- 1 = Rarely (once or twice in the past four weeks)
- 2 = Sometimes (three to ten times in the past four weeks)
- 3 = Often (more than ten times in the past four weeks)

5. **In the past four weeks, did you have to eat a smaller meal than you felt you needed because there was not enough food?**

- 0 = No (skip to Q6)
- 1 = Yes

How often did this happen?

- 1 = Rarely (once or twice in the past four weeks)
- 2 = Sometimes (three to ten times in the past four weeks)
- 3 = Often (more than ten times in the past four weeks)

6. **In the past four weeks, did you have to eat fewer meals in a day because there was not enough food?**

- 0 = No (skip to Q7)
- 1 = Yes

How often did this happen?

- 1 = Rarely (once or twice in the past four weeks)
- 2 = Sometimes (three to ten times in the past four weeks)
- 3 = Often (more than ten times in the past four weeks)

7. **In the past four weeks, was there ever no food to eat of any kind in your household because of lack of money to get food?**

- 0 = No (skip to Q8)
- 1 = Yes

How often did this happen?

- 1 = Rarely (once or twice in the past four weeks)
- 2 = Sometimes (three to ten times in the past four weeks)
- 3 = Often (more than ten times in the past four weeks)

8. **In the past four weeks, did you go to sleep at night hungry because there was not enough food?**

- 0 = No (skip to Q9)
- 1 = Yes

How often did this happen?

- 1 = Rarely (once or twice in the past four weeks)
- 2 = Sometimes (three to ten times in the past four weeks)
- 3 = Often (more than ten times in the past four weeks)

9. **In the past four weeks, did you go a whole day and night without eating anything because there was not enough food?**

- 0 = No
- 1 = Yes

How often did this happen?

- 1 = Rarely (once or twice in the past four weeks)
- 2 = Sometimes (three to ten times in the past four weeks)
- 3 = Often (more than ten times in the past four weeks)

C. FOOD FREQUENCY QUESTIONNAIRE

Instructions

- Look at the food item list (column 1)
- Think back carefully over the past month and determine how often you ate each item
- If you eat/drink a specific item less than once a month, mark the Never/<1/ month column.
- If you do eat/drink it more regularly, decide how often you eat it per month, OR per week, OR per day and make a cross (X) in the column which best applies to each item in the food list.
- Only make one cross (X) for each item in the list e.g. for each row in the table.

	Never/ <1/ month	**1-3/ month**	**1/ week**	**2-4/ week**	**5-6/ week**	**1/ day**	**2-3/ day**	**4-5/ day**	**6+/ day**
STARCHES									
White or brown bread and/or buns/ rolls									
Whole wheat, health, Low GI, seed bread and/or rolls etc.									
Breakfast cereals or porridge such as All Bran, High Bulk Bran, Muesli, Weet-bix, Pronutro, Oats, etc.									
Breakfast cereals such as Rice Crispies, Cornflakes, Coco Pops, Fruit Loops, Maize meal porridge, Morevite etc.									
Rice, mealie rice, samp, phutu, pap, jeqe (steamed bread)									
Pasta: macaroni, spaghetti, noodles									
Potato: cooked, baked, mashed									
Potato: cooked, baked, mashed with fat e.g. margarine added or potato salad									

Legumes e.g. baked beans, lentils, dahl, harricot beans, split peas, broad beans, kidney beans, sugar beans, dried bean salad/soup, soya mince etc.									
VEGETABLES									
Cooked vegetables: any type. (no sugar/ fat/ sauce added)									
Vegetables: any type prepared with sugar/ fat/ sauces e.g. white sauce.									
Mixed salad: lettuce, cucumber, tomato, peppers, onions, mushrooms, carrots in any combination or alone.									
FRUIT									
Fresh fruit (any type)									
Dried fruit (any type)									
Fruit juice									
Fruit salad: fresh or tinned									
	Never/ <1/ month	**1-3/ month**	**1/ week**	**2-4/ week**	**5-6/ week**	**1/ day**	**2-3/ day**	**4-5/ day**	**6+/ day**
MILK, YOGHURT AND CHEESE									
Full cream: milk, yogurt, sour milk (maas), powdered milk (e.g. Nespray, Klim)									
Skimmed/ low fat/2%: milk, yogurt, sour milk (maas)									
Coffee creamer: in tea/coffee e.g. cremora									
Milk drinks: Milo, Nesquik, Horlicks									

Cheese: gouda, cheddar, camembert, brie, edam (except low fat/ fat-free cottage cheese), cheese spread									
MEAT, FISH, CHICKEN									
Schnitzels, Cordon Bleu									
Red meat e.g. beef, mutton, pork. (Eat meat and visible fat)									
Red meat e.g. beef, mutton, pork. (Eat meat, but remove visible fat)									
Red meat e.g. venison & ostrich.									
Chicken/turkey: with skin									
Chicken/turkey: without skin									
Fried fish in any fat or oil, with or without batter/crumbs.									
Fish: steamed, grilled, braaied (fire)									
Fish: tinned sardines, pilchards, salmon, tuna									
Sausages: Vienna's, Russians, frankfurter									
Cold meat: polony, salami, etc. & bacon									
Organ meat e.g. liver, kidney, tripe									
Eggs: cooked or poached									
Eggs: scrambled, baked, omelettes									
FATS									
Soft margarine (in a tub)									
Butter/hard margarine, ghee									

Cooking oil e.g. sunflower oil									
Dripping									
Fat e.g. Holsum									
Salad dressing, mayonnaise: normal fat									
Salad dressing, mayonnaise: lite/ low fat									
	Never/ <1/ month	**1-3/ month**	**1/ week**	**2-4/ week**	**5-6/ week**	**1/ day**	**2-3/ day**	**4-5/ day**	**6+/ day**
FAST FOODS AND TAKE AWAYS									
Pizza									
Pies & Sausage rolls									
Potato chips (French fries)									
Kentucky Fried Chicken									
Nando's									
Chickin Lickin, Chicken King									
Fried fish									
Bunny chow									

Hot dogs									
Hamburgers (= bun and meat or chicken patty) e.g. McDonalds, Steers, Wimpy, Spur, other restaurants etc.									
OTHER									
Vetkoek (amagwinya), samoosas, koeksister, doughnuts									
Muffin, scones, cake, tart									
Rusks: commercial or homemade e.g. bran, buttermilk, white, whole wheat etc.									
Cookies: commercial or homemade: e.g. oat, crunchies, shortbread									
Chips: Nik naks, Lays, Simba etc.									
Energy bars, health bars, breakfast bars									
Chocolate									
Ice cream									
Cheese sauce, white sauce, meat sauces									
Tomato sauce, chutney, mustard, sweet chilli sauce									
Sweets e.g. jelly tots, sour worms, super-C's etc.									
Nuts and peanuts									
Peanut butter									
Chocolate spread									

Jam, syrup, honey									
	Never/ <1/ month	**1-3/ month**	**1/ week**	**2-4/ week**	**5-6/ week**	**1/ day**	**2-3/ day**	**4-5/ day**	**6+/ day**
DRINKS									
Wine: red or white									
Port, sherry, liqueur									
Beer, cider, coolers e.g. castle, black label, hunters dry, Savanna, Smirnoff etc.									
Beer, cider, cooler diet/ light e.g. Savanna light									
Spirits: e.g. brandy, whisky, rum, vodka, gin.									
Cocktails									
Shooters									
Fizzy soft drinks: e.g. Coke, Fanta									
Fizzy diet soft drinks: e.g. Coke lite etc.									
Energy drinks e.g. Energade, Powerade									
Milkshake									
Drinking yoghurt									
EATING PLACE									

In general, how often do you eat out e.g. restaurant, take-aways, hotel, prepared food/ meals from Spar, Checkers etc.									
If you work during the day (away from your home), how often do you take food from your home with you to eat during the day.									
If you work during the day (away from home), how often do you buy food to eat during the day.									

D. SOCIO-DEMOGRAPHIC QUESTIONNAIRE

1. What is the highest level of education your mother has completed?

a. Primary school ……....1

(If YES, please indicate highest grade completed) …….

b. High school ……..…….…….…2

(If YES, please indicate highest grade completed) ……..

a. Tertiary (e.g. University or University of Technology)…...…… 3

2. What is the highest level of education your father has completed?

a. Primary school ……....1

(If YES, please indicate highest grade completed) …….

b. High school ……..…….…….…2

(If YES, please indicate highest grade completed) ……..

b. Tertiary (e.g. University or University of Technology)…...…… 3

3. How many people are currently living in your household, including yourself? .....

4. Please describe the home where you live.

(Check "Yes" or "No" for each question. Check "Yes" to all that apply.)

		Yes	**No**
a. It is owned by parent/guardian……..……	1	2	
b. It is rented by parent/guardian……. ……..	1	2	
c. It is occupied without payment or money or rent. …….	1	2	

d. I live with friends. …… 1 2

e. I live with family. ……. 1 2

f. I have no permanent residence. …….. 1 2

5. How many rooms are in your home? …….

6. How many bedrooms are in your home?

…….

	Yes	**No**
7. Do you have a tap in your home? ……..……	1	2

8. Check the box that best corresponds to your mother's current work situation.

(Check "Yes" or "No" for each question.)

	Yes	**No**
a. Working full time ……	1	2
b. Working part time ……..	1	2
c. Unemployed …….	1	2
d. Disabled……..…….	1	2
e. Retired ……..…….	1	2

9. Check the box that best corresponds to your father's current work situation.

(Check "Yes" or "No" for each question.)

	Yes	**No**

a. Working full time …… 1 2

b. Working part time ……... 1 2

c. Unemployed ……..……. 1 2

d. Disabled……...……. 1 2

e. Retired ……...……. 1 2

E. NUTRITION KNOWLEDGE QUESTIONNAIRE (IsiZulu Version)

1. **Kumele udle ushukela omningi ukuze ube nomfutho owanele** IQINISO/AKUSILO IQINISO

2. **Ukudla okudliwa umuntu wesifazane okhulelwe akunawo umphumela empilweni yakhe nasengani** IQINISO/AKUSILO IQINISO

3. **Akumele udle istashi ekudleni okuningi ngoba**:

e) Asibalulekile empilweni yakho

f) Ngisho ungadla esincane kubanga ukunyuka kwesisindo somzimba

g) Sibanga izifo

h) Akubaliwe ngenhla

4. **Kumele uphuze amanzi angakanani ngosuku?**

e) Akudingi uphuze amanzi zonke izinsuku

f) 1 to 3 amaglasi

g) 4 to 6 amaglasi

h) 7 to 9 amaglasi

5. **Kumele ufake usawoti ekudleni osekuphekiwe ngaphambi ngokuba ukudle** IQINISO/AKUSILO IQINISO

6. **Kulokudla okubalwe ngezansi ikuphi okumele udle okuningi kwakho zonke izinsuku?**

e) Isinkwa, istambu, i-rice, iphalishi

f) Ama-apula, ubhanana, i-spinach, ukherothi

g) Ubisi, i-yogurt, ushizi

h) Inkukhu, ufishi, ubhontshisi, amaqanda

7. **Ikuphi kuloku okungekho kuhle ukuthi kwenziwe umuntu wefazane okhulelwe?**

e) Ukujima

f) Ukudla izinhlobo nhlobo zokudla

g) Ukulala kakhulu

h) Ukuphuza amanzi amaningi

8. **Abantu abanesisindo somzimba esiphezulu akumele bajime?** IQINISO/AKUSILO IQINISO

9. **Isiphi kulama-snack esinempilo?**

e) Iglasi yobisi

f) Indishi ya-popcorn enerama

g) Ushokolethi

h) b and c ngenhla

10. **Ikuphi ukudla okunempilo okubalulekile kuloku:**

e) Ukudla okunhlobo nhlobo

f) Ukudla okunye ukudla kaningi kunokunye

g) Ukudla ezinye izinhlobo zokudla ngokwanele noma kancane

h) Konke loku okungenhla

11. Ikuphi kulokudla okubaliwe ngezansi okumele kudliwe uma uzama ukunciphisa isisindo somzimba

e) Isinkwa nelayisi

f) Inyama nofishi

g) I-margarine

h) Akubaliwe ngenhla

12. **Uma uzama ukunyusa i-fibre ekudleni, ikuphi okukodwa kulokhu okubaliwe ngezansi okumele udle okuningi kwakho?**

e) Amakheke namabhiskidi

f) Ama-apula nokherothi

g) Ama-chips nophaya

h) Inkukhu nofishi ofresh

13. **Ikuphi kulokhu okubalwe ngezansi okusiza ekuvikeleni kwezinye izifo?**

e) Ufishi, inkukhu engenaso iskhumba, and inyama enganonile

f) Isausage yebeef, ubhekeni nemince enganonile

g) Ufishi nenkukhu okwenziwe ngamafutha, nemince

h) Konke okungenhla

14. **Ikuphi ukudla kulokhu okune-Fibre eningi?**

e) Ama-oats, ama-apula, ubhontshisi

f) Ubisi, i-yoghurt, ushizi

g) I-beef, inkukhu, i-mutton

h) Ibhotela, i-margarine

15. **Kumele udle izithelo nemfino engaki?**

e) Isithelo nemfino eyodwa ngosuku

f) Izithelo nemfino eziwu3-4 ngosuku

g) Izithelo nemfino eziwu5 naphezulu ngosuku

h) Asikho isidingo sokudla izithelo nemfino zonke izinsuku

16. **Uma udla ukudla okunempilo asikho isidingo sokujima** IQINISO/AKUSILO IQINISO

17. **Ungaphuza iwayini, utshwala kanye namanye amanzi aponjwana** IQINISO/AKUSILO IQINISO

18. **Umzimba wakho udinga usawoti omncane ukuze ube nempilo** IQINISO/AKUSILO IQINISO

19. **Ukudla okuzokunika yonke imisoco edingwa uzimba ikuphi kulokhu:**

e) Okunenyama eningi, kube nestashi, izithelo, imfino kanye nobisi oluncane

f) Okunemfino eningi, kube nenyama nokwakhiwe ngobisi okuncane

g) Okunestashi nezithelo eziningi, kube nenyama nokwakhiwe ngobisi okuncane

h) Akubaliwe ngenhla

20. **Ushukela nokudla okunoshukela kumele kudliwe kancane**: IQINISO/AKUSILO IQINISO

21. **Ukudla ukudla okuningi okuyizinhlobo nhlobo kungcono kunokudla ukudla okuncane** IQINISO/AKUSILO IQINISO

22. **Akwenzeki ukuthi uthole yonke imisoco edingwa umzimba, kmele uphuze namaphilisi azokunika umsoco** IQINISO/AKUSILO IQINISO

23. **Abesimame abanesisindo somzimba esiphezulu kumele bazame ukuncipha uma bekhulelwe** IQINISO/AKUSILO IQINISO

24. **Ushukela unawowonke umsoco odingeka emzimbeni** IQINISO/AKUSILO IQINISO

25. **Imaphi kulamaqembu emisoco atholakala ngokuningi kwizithelo nemfino**?

e) I-Fibre, u-Vitamin A

f) Isitashi, amafutha, u-Vitamin D

g) Amafutha, i-Iron, i-Calcium

h) Akubaliwe ngenhla

26. Ikuphi kulezidlo zasekuseni ezinama futha amancane?

e) Ithosti ye-whole wheat egcotshwe kancane ngerama

f) Iweet-bix efakwe ubisi oluwu 2%

g) Ubekeni namaqanda

h) a and b

27. Kubalulekile ukuthi umuntu okhulelwe angadli izinhlobo nhlobo eziningi zokudla IQINISO/AKUSILO IQINISO

28. Wonke amanzi aphephile ukuthi uwaphuze IQINISO/AKUSILO IQINISO

29. Ukuphuza amanzi abilisiwe indlela enhle yokunciphisa isisindo somzimba IQINISO/AKUSILO IQINISO

30. Ukudla isinkwa njalo kudala ukuthi umuntu anyukelwe isisindo somzimba IQINISO/AKUSILO IQINISO

31. Ikuphi ukudla kulokhu okune-fibre eningi kuloku?

e) Amaroli amhlophe

f) Isinkwa esinsundu

g) Isinkwa esimhlophe

h) Isinkwa se-whole wheat

32. Ukuze uqinisekise ukuthi uhlala unempilo, kumele udle:

a) Inyama enganonile, izithelo namavegi, imikhiqizo yokwenziwe ngobisi okunganawo amafutha amaningi, izinkwa nokusanhlamvu

b) Izithelo namavegi kuphela

c) Isinkwa, okusanhlamvu, izithelo namavegi kuphela

d) Imikhiqizo yokwenziwe ngobisi okunganawo amafutha amaningi nenyama enganonile

33. Kulodula okulandelayo, ikuphi okunamafutha amancane:

a) ama- corn flakes nobisi olunamafutha amaningi

b) inyama yenkomo enganonile eshisiwe nokherothi obilisiwe

c) Ipizza nesphuzo esenzwe ngobisi

d) Inyama yesiklabhu esithosiwe nemfino eshuniwe

34. Ukunyakazisa umzimba kuchaza ukuthi:

a) ukuya ejimini

b) ukuhamba ibanga elide

c) ukudla ibhola namanye ama-sport

d) konke okubalwe ngenhla

35. ukuze ungabi nezifo kumele ungadli ukudla okuhluke hlukene ? IQINISO/ AKULONA IQINISO

36. Kunempilo ukudla ukudla okunoshukela omningi? IQINISO/AKULONA IQINISO

37. Ikuphi ukudla umuntu okhulelwe ekumele ekudle kakhulu?

a) ubisi, ushizi, amasi

b) inyama, inkhukhu, inhlanzi

c) izithelo namavegi

d) konke okubalwe ngenhla

38. Ikuphi ukudla okunama futha amancane?

a) amaSimba chips

b) ama-popcorn

c) amachips afriyiwe

d) ama-niknaks

39. Ubhontshisi, amalentils nophizi kumele kudliwe kaningi ngesonto ?

IQINISO/AKULONA IQINISO

40. Inyama ungayidla noma ikangakanani zonke izinsuku? IQINISO/AKULONA IQINISO

41. Kungcono ukudla ubhontshisi, amalentils nophizi kunokudla inyama?

IQINISO/AKULONA IQINISO

42. Isizathu esenza ubhontshisi, amalentils nophizi abe nempilo:

a) lokudla kunama futha amancane

b) ane-fibre eningi

c) ayakuvikela ekutholeni izifo

d) konke okubalwe ngenhla

F. HOUSEHOLD FOOD INSECURITY ACCESS SCALE (HFIAS) (IsiZulu Version)

1. Kulama sonto awu-4 adlulile, uke wakhathazeka ukuthi kungenzeka ungabi nokudla okwanele?

-0= cha (dlulela kumbuzo wesbili)

-1= yebo

Kwenzeka kangaki?

-1 = Akujwayele ukwenzeka (kanye noma kabili kwama sonto awu-4 adlulile)

-2 = Kujwayele ukwenzeka (kathathu noma kawu-10 kwamasonto awu-4 adlulile)

-3 = Kuhlezi kwenzeka (ngaphezulu kwa 10 kwamasonto awu-4 adlulile)

2. **Kulama sonto awu-4 adlulile, ubungakwazi ukudla ukudla okuthandayo ngenxa yokuthi bekushoda imali?**

1= 0 cha (dlulela kumbuzo westhathu)

2= yebo

Kwenzeka kangaki?

-1 = akujwayele ukwenzeka (kanye noma kabili kwama sonto awu-4 adlulile)

-2= kujwayele ukwenzeka (kathathu noma kawu-10 kwamasonto awu-4 adlulile)

-3= kuhlezi kwenzeka (ngaphezulu kwa 10 kwamasonto awu-4 adlulile)

3. kulama sonto awu-4 adlulile, ubudla ukudla okufanayo mihla namihla ngenxa yokuthi bekushoda imali?

1= 0 cha (dlulela kumbuzo wesi-4)

2= yebo

Kwenzeka kangaki?

-1 = akujwayele ukwenzeka (kanye noma kabili kwama sonto awu-4 adlulile)

-2 = kujwayele ukwenzeka (kathathu noma kawu-10 kwamasonto awu-4 adlulile)

-3= kuhlezi kwenzeka (ngaphezulu kwa 10 kwamasonto awu-4 adlulile)

4. kulama sonto awu-4 adlulile, ubudla ukudla obungafuni ukukudla ngenxa yokuthi bekushoda imali noma yokuthenga okunye ukudla?

1= 0 cha (dlulela kumbuzo wesi-5)

2= yebo

Kwenzeka kangaki?

-1 = akujwayele ukwenzeka (kanye noma kabili kwama sonto awu-4 adlulile)

-2= kujwayele ukwenzeka (kathathu noma kawu-10 kwamasonto awu-4 adlulile)

-3= kuhlezi kwenzeka (ngaphezulu kwa 10 kwamasonto awu-4 adlulile)

5. kulama sonto awu-4 adlulile, bewuphoqwa isimo esidale ukuthi udle ukudla okuncane kunenjwayelo ngenxa yokuthi bekushoda ukudla?

1= 0 cha (dlulela kumbuzo wesi-6)

2= yebo

Kwenzeka kangaki?

-1 = akujwayele ukwenzeka (kanye noma kabili kwama sonto awu-4 adlulile)

-2= kujwayele ukwenzeka (kathathu noma kawu-10 kwamasonto awu-4 adlulile)

-3= kuhlezi kwenzeka (ngaphezulu kwa 10 kwamasonto awu-4 adlulile)

6. kulama sonto awu-4 adlulile, bewuphoqwa isimo esidale ukuthi udle ukudla okuncane kunenjwayelo ngenxa yokuthi bekushoda ukudla?

1= 0 cha (dlulela kumbuzo wesi-7)

2= yebo

Kwenzeka kangaki?

-1 = akujwayele ukwenzeka (kanye noma kabili kwama sonto awu-4 adlulile)

-2= kujwayele ukwenzeka (kathathu noma kawu-10 kwamasonto awu-4 adlulile)

-3= kuhlezi kwenzeka (ngaphezulu kwa 10 kwamasonto awu-4 adlulile)

7. kulama sonto awu-4 adlulile, kuseke kwenzeka kwangaba khona ukudla ngenxa yokuthi bekushoda imali?

1= 0 cha (dlulela kumbuzo wesi-8)

2= yebo

Kwenzeka kangaki?

-1 = akujwayele ukwenzeka (kanye noma kabili kwama sonto awu-4 adlulile)

-2= kujwayele ukwenzeka (kathathu noma kawu-10 kwamasonto awu-4 adlulile)

-3= kuhlezi kwenzeka (ngaphezulu kwa 10 kwamasonto awu-4 adlulile)

8. kulama sonto awu-4 adlulile, kuseke kwenzeka ukuthi ulale ulambile ngenxa yokuthi bekushoda ukudla?

1= 0 cha (dlulela kumbuzo wesi-9)

2= yebo

Kwenzeka kangaki?

-1 = akujwayele ukwenzeka (kanye noma kabili kwama sonto awu-4 adlulile)

-2= kujwayele ukwenzeka (kathathu noma kawu-10 kwamasonto awu-4 adlulile)

-3= kuhlezi kwenzeka (ngaphezulu kwa 10 kwamasonto awu-4 adlulile)

9. kulama sonto awu-4 adlulile, kuseke kwenzeka ukuthi ungadli lutho usuku kanye nobusuku bonke ngenxa yokuthi bekungekho ukudla?

1= 0 cha (dlulela kumbuzo wesi-10)

2= yebo

Kwenzeka kangaki?

-1 = akujwayele ukwenzeka (kanye noma kabili kwama sonto awu-4 adlulile)

-2= kujwayele ukwenzeka (kathathu noma kawu-10 kwamasonto awu-4 adlulile)

-3= kuhlezi kwenzeka (ngaphezulu kwa 10 kwamasonto awu-4 adlulile)

G. SOCIO-DEMOGRAPHIC QUESTIONNAIRE (IsiZulu Version)

1. Iliphi ibanga lemfundo eliphezulu umama wakho aliqeda? (Ketha impendulo EYODWA)ubhale ibanga ngezansi kwa lokho okukhethethile

b. Primary school ……....1

(Uma yebo, sicela ubhale ibanga agcina kulo) …….

b. High school ……..…….……..…2

(Uma yebo, sicela ubhale ibanga agcina kulo) ……..

c. Tertiary (e.g. University or University of Technology)…...…… 3

2. Iliphi ibanga lemfundo eliphezulu ubaba wakho aliqeda?

b. Primary school ……....1

(Uma yebo, sicela ubhale ibanga agcina kulo) …….

b. High school ……..…….……..…2

(Uma yebo, sicela ubhale ibanga agcina kulo) ……..

d. Tertiary (e.g. University or University of Technology)…...…… 3

3. Bangaki abantu ohlala nabo endlini, nawe uzibale? .....

4. Nihlala kanjani ekhaya.

(Khetha u "Yebo" noma "cha" kulemibizo. Check "Yes" to all that apply.)

	Yes	**No**
a. Umuzi owomzali noma lo ohlala naye……..…	1	2
b. Kuqashe umzali noma lo ohlala naye……. …….	1	2
c. La nihlala khona nihlala mahhala …….	1	2
d. Uhlala nabangani ……	1	2

e. Uhlala nomndeni. …… 1 2

f. Angihlali endaweni eyodwa ……. 1 2

5. Kukhona amagumbi amangaki endlini? (Ubale nezindlu zangaphandle; ungalibali igaraji

……

6. Mangaki amagumbi okulala endlini? …….

	Yebo	**Cha**
7. Ukhona umpompi endlini? ……..…….	1	2

8. Khetha kuloku okulandelayo okuchaza umsebenzi okamama wakho

(Khetha u "Yebo" noma "cha" kulemibuzo)

	Yebo	**Cha**
a. Uyasebenza (noma uyazisebenza)……	1	2
b. Unetoho ……..	1	2
c. Akasebenzi ……..……	1	2
d. Ukhubazekile……..……..	1	2
e. Useyekile umsebenzi (impesheni) ……..……	1	2

9. Khetha kuloku okulandelayo okuchaza umsebenzi okababa wakho

(Khetha u "Yebo" noma "cha" kulemibuzo)

		Yebo	**Cha**
a. Uyasebenza (noma uyazisebenza)……	1	2	
b. Unetoho ……..	1	2	
c. Akasebenzi ……..……	1	2	
d. Ukhubazekile……..……..	1	2	
e. Useyekile umsebenzi (impesheni) ……..……	1	2	

H. INFORMED CONSENT FORM (English Version)

Nutrition knowledge, food security and dietary diversity of adolescents attending an urban and a peri-urban school

I would like to invite you to take part in a research study that examines the level of nutrition knowledge of adolescents, as well as their food security status and dietary diversity. You have been invited to take part in this study because you are a grade 10 learner that attends either an urban or a peri-urban school. Please take some time to read the information presented here, which will explain the details of this study. Please feel free to ask either myself or the study staff any questions about any part of this study that you may not understand. It is very important that you are fully satisfied and that you clearly understand what this research is about and the role you would play if you decide to be involved. Please know that your participation is **completely voluntary** and you are free to decline to take part. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you agreed to take part initially.

Approval for this study was given by the Ethics Sub-Committee (Humanities and Social Sciences) of the University of KwaZulu-Natal (UKZN) and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

The purpose of this research study is to compare the level of nutrition knowledge, the food security status and the dietary diversity of adolescent learners from an urban school and a peri-urban school. The idea is that the social and economic background of a person may affect their choices of food, and as an extension of that, their overall level of food security.

Why have you been invited to participate?

You have been invited to participate in this study because you are in grade 10 and you attend either an urban or a peri-urban school.

What will you be asked to do?

This study will ask participants to complete three questionnaires (nutrition knowledge, household food insecurity access scale, dietary diversity) that should take no longer than 20 minutes each. This will help to gain information on the nutrition knowledge, household food security and range of foods consumed by participants. Also, the height, weight and mid-upper arm circumference (MUAC) of participants will be measured while still in their uniform, in order to gain some information on the nutrition status of the learners.

Will you benefit from taking part in this research?

The results of this study may be used to develop a program to provide nutrition education to adolescents. You will not be paid for your participation; however, it will not cost you anything to take part. As I mentioned earlier, if you choose to take part in this study, you are free to withdraw at any time, and you will not face any negative consequences.

Who will have access to the information collected and how will your identity be protected?

If you choose to take part in this study, you will be given a code number and your name will never be used. This will be done to protect your identity. Also, all the information you provide in the questionnaire will be kept confidential and not shared with anyone who is not part of the study. All information collected will be stored in a secure location and kept for a period of at least five years. When the study is completed, the results may be published for scientific purposes, but your identity will never be revealed.

Are there any risks involved in your taking part in this research?

There are no physical or emotional risks involved in taking part in this study. **As the study does not involve any blood sample collecting or drug testing, it is highly unlikely that any injury will occur should you decide to take part in this study.**

Should you have any further queries regarding the study, please feel free to contact Mrs Suna Kassier or Mr Keiron Audain any of the numbers or email addresses listed at the end of this document.

You will receive a copy of this information and consent form for your own records.

Declaration by participant

By signing below, I ……..……. agree to take part in a research study entitled "**Nutrition knowledge, food security and dietary diversity of adolescents of different socioeconomic backgrounds**".

I declare that:

- I have read or had read to me this information and consent form and it is written in a language in which I am fluent and am comfortable with.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to withdraw from the study at any time and will not be penalised or prejudiced in any way as a result.
- I may be asked to withdraw from the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) .....….....…….. on (*date*) ……...…….. 2013.

.....	.....
Signature	Signature of witness
.....	.....
Designation	Name of witness

Declaration by investigator

I *(name)* ……..…… declare that:

- I explained the information in this document to ……..
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use a interpreter. (*If a interpreter is used then the interpreter must sign the declaration below.*

Signed at (*place*) .....….....…….. on (*date*) ……...…….. 2013.

.....	.....
Signature of investigator	Signature of witness
.....	.....
Name of investigator	Name of witness

Keiron Audain (210555698)

Discipline of Dietetics and Human nutrition

School of Agricultural, Earth and Environmental Sciences

University of Kwa-Zulu Natal

Pietermaritzburg

Contact Details:

Phone: (033)260 6063

Mobile: 0726546384

Email: keiron.audain@gmail.com

Suna Kassier MSc Diet, RD(SA)

Academic Coordinator: Post Grad Diploma in Dietetics and Community Nutrition

Discipline of Dietetics and Human Nutrition

School of Agricultural, Earth & Environmental Sciences

College of Agriculture, Engineering & Science

University of KwaZulu-Natal

Scottsville

Phone: (033) 260 5431

Fax: (033) 260 6270

Cell: 083 658 8349

Email: kassiers@ukzn.ac.za

I. INFORMED CONSENT FORM (IsiZulu Version)

Nutrition knowledge, food security and dietary diversity of adolescents attending an urban and a peri-urban school

Imvumo yokwenza lolucwaningo inikezwe yi-Ethics Sub-Committee (Humanities and Social Sciences) yeNyuvesi yaKwaZulu-Natali (UKZN) futhi izokwenziwa kulandelwa imigomo AND GUIDELINES yokuziphatha ye-international Declaration of Helsinki, South African Guidelines for Good Clinical Practice kanye nemiGUIDELINES okuziphatha ekwenziweni kocwaningo ngabakwaMedical Research Council (MRC).

Ingabe lolucwaningo lumayelana nani?

Inhloso yaloluphenyo ukuqhathanisa izinga lolwazi ngezokudla okukanye i-nutrition, ukuphepha kokudla (food security) kanye nokuba nokudla okunhlobonhlobo kubafundi asebebadala ezikoleni zasemalokishini (URBAN) nezase (PERI-URban). Loku kulandela umucabango wokuthi isimonhlalo kanye nezezimali zalapho umuntu eqhamuka khona kungaba nomthelela kwinhlobo yokudla abakukhethayo, ngenxa yalokho bese kuthinteka izinga lokuphepha kokudla (food security) kwabo.

Ingabe kungani umenywa ukuba ube yingxenye yalolucwaningo?

Umenywe ukuba yingxenye yaloluphenyo ngoba wenza ibanga leshumi (Grade 10) futhi uya esikoleni saselokishini (URBAN or a PERI-URBAN).

Ikuphi ozocelwa ukuthi ukwenze?

Uzocelwa ukuba ugcwalise amafomu anemibuzo amathathu (mayelana nolwazi ngezokudla, Household food insecurity access scale (HFIAS), ubunhlobonhlobo bokudla), ifomu ngalinye lizothatha ngaphansi kwemizuzu engamashumi amabili. Lokhu kuzosiza ukuthi sithole ulwazi ngolwazi ngezokudla, ukuphepha kokudla emndenini kanye mayelana ngezinhlobonhlobo zokudla ezidliwa abayingxenye yophenyo. Ubude, isisindo kanye nobungako bengalo engenhla (Mid upper-

arm circumference- MUAC) kwabayingxenye yocwaningo kuzokalwa abafundi besaqgoke umfaniselwano wesikole ukuze kutholakale ulwazi lokuthi bamekuphi ngempilo.

Ingabe uzohlomula ngokuba ingxenye yalolucwaningo?

Imiphumela yalolucwaningo ingasiza ukuqala uhlelo lokufundisa abafundi abangangawe ngezokudla. Ngeke ukhokhelwe ngokubayingxenye kanti futhi awudingi ukukhokha ukuze ube yingxenye. Njengoba sekuke kwashiwo phambilini uma ukhetha ukuba ingxenye yocwaningo uvumelekile ukuhoxa noma ngabe inini futhi ngalokho ngeke ubhekane nemivuzo emibi (negative consequences).

Ubani uzoba negunya lokubona ulwazi oluzoqoqwa futhi imininingwane yakho izovikeleka kanjani?

Uma ubayingxenye yocwaningo uzonikwa inombolo eyikhodi, igama lakho ngeke lisetshenziswe nhlobo. Lokhu kuzokwenziwa ukuvikela ukuthi ungubani. Futhi, lonke ulwazi ozolubhala kwifomi lizogcinwa ngokuyimfihlo, ngeke lukhonjiswa abanye abantu. Lonke ulwazi oluzoqoqwa luzogcinwa endaweni ephephile isikhathi esingaba iminyaka emihlanu. Uma ucwaningo seluphelile imiphumela kungenzeka ishicilelwe emabhukwini esayensi kodwa ngeke igama lakho livezwe.

Ingabe bukhona ubungozi ekutheni ube ingxenye yololuphenyo?

Abukho ubungozi ongabhekana nabo enyameni nakumoya ngokuba ingxenye. Ngokuba kulolucwaningo ngeke kuthathwe amasampuli egazi noma kuphenywe izidakamizwa amathuba okulimala mancane kakhulu uma ukhetha ukuba ingxenye.

Uma kwenzeka uba nemibuzo mayelana naloluphenyo, khululeka ukuthintana noNksz Suna Kassier noma uMnu Keiron Audain kunoma iyiphi inombolo noma i-e-mail okubhalwe ekugcineni kwefomu. Uzothola ikhophi yalolulwazi kanye nefomu lokuzibophezela ozoligcina wena.

Okuvunywa oyingxenye yophenyo

Ngokusayina ngezansi, mina (bhala igama lakho).....ngiyavuma ukuba yingxenye yocwaningo olunesihloko esithi "Nutrition knowledge, food security and dietary diversity of adolescents of different socioeconomic backgrounds"

Ngiyavuma ukuthi:

- Ngifundile noma khona ongifundele ulwazi olukulelifomu futhi libhalwe ngolimi engiluzwayo nengikhululekile ngalo.
- Ngibe nethuba lokubuza imibuzo futhi yonke imibuzo ebenginayo iphendulwe ngokwaneliseka.
- Ngiyaqonda ukuthi ukuze ngibeyingxenye yalolucwaningo ingoba ngithanda hhayi ngoba ngiphoqiwe,
- Ngingahoxa noma ngabe inini uma ngithanda kanti lokho ngeke kube nomthelela omubi kumina.
- Ngingacelwa ukuthi ngihoxe ekubeni ingxeye yocwaningo ngaphambi kokuba luphothulwe uma umcwaningi ebona kungifanele noma ngingalandeli uhlelo njengoba ngizobe ngivumile ukwenza.

Lisayinywe (indawo).....ngezi (usuku).....2013

……..…… ……..…….....……

I-signature (Yakho) **I-signature (yoseduze kwakho)**

…… ……...…….

Kafakazi Indawo (bhala igama lakho) **Igama likafakazi (oseduze kwakho)**

<u>Okuvunywa umphenyi</u>

Mina (igama lakho).....ngiyavuma ukuthi:

- Ngichaze ulwazi olukulelifomu ku
- Ngimukhuthazile ukuthi abuze imibuzo futhi ngathatha isikhathi esanele ukuyiphendula.
- Ngigculisekile ukuthi uyawaqonda onke amahlandla ocwaningo njengoba kuchazwe ngenhla
- Ngisebenzise/ angimusebenzisanga utolika.(Uma utolika esetshezisiwe kumele esayini ngezansi).

Isayinywe e(indawo).....ngezi(usuku).....2013

J. Ethical Approval

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

6 May 2013

Mr Keiron Audain 210555698
School of Agriculture, Earth and Environmental Sciences
Pietermaritzburg Campus

Dear Mr Audain

Protocol reference number: HSS/0271/013D
Project title: Nutrition knowledge, food security and dietary diversity of adolescents of different socioeconomic backgrounds

EXPEDITED APPROVAL

I wish to inform you that your application has been granted Full Approval through an expedited review process.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. Please note: Research data should be securely stored in the school/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

Professor Steven Collings (Chair)

/pm

cc Supervisor: Professor Frederick Veldman & Mrs Suna Kassier
cc Academic Leader: Prof D Jaganyi
cc School Admin.: Ms Michelle Francis/Ms Sibongile Ntuli

Humanities & Social Sc Research Ethics Committee
Professor S Collings (Chair)
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban, 4000, South Africa
Telephone: +27 (0)31 260 3587/8350/4557 **Facsimile:** +27 (0)31 260 4609 **Email:** ximbap@ukzn.ac.za / snymanm@ukzn.ac.za / mohunp@ukzn.ac.za
Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

INSPIRING GREATNESS