



PENINSULA TECHNIKON

THE PREVALENCE OF OBESITY AMONGST
LEARNERS ATTENDING THE SCHOOLS IN
BELHAR, DELFT AND MFULENI

AVRIL SOMERS

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TECHNIKON

**THE PREVALENCE OF OBESITY AMONGST
LEARNERS ATTENDING THE SCHOOLS IN
BELHAR, DELFT AND MFULENI IN CAPE TOWN,
SOUTH AFRICA**

**Dissertation submitted in fulfilment of the requirements
of the Degree:**

Master in Technology: Biomedical Technology

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By

**Candidate: Avril Somers
Student Number: 9842721**

Internal Supervisor: Mr Emmanuel Rusford

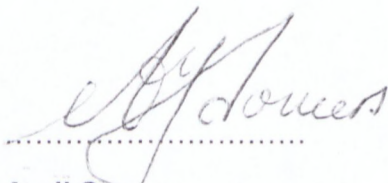
External Supervisor: Professor Rajiv T Erasmus

Date of Submission: September 2004

STATEMENT OF DECLARATION

THE PREVALENCE OBESITY AMONGST LEARNERS ATTENDING SCHOOLS IN BELHAR, DELFT AND MFULENI

With this statement, I Avril Somers, affirm that the research work upon which this thesis is supported on is my own (except where acknowledgements indicate otherwise), and that neither the entire research endeavor nor any part of it has been, is being, or is to be submitted for another degree in this or any other educational institution.

A handwritten signature in cursive script, appearing to read 'Avril Somers', written over a horizontal dotted line.

Avril Somers

September 2004

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ABBREVIATIONS

BIA – Bioelectrical Impedance Analysis

BMI – Body Mass Index

BP – Blood Pressure

CDC – Center for Disease Control

CI – Confidence Interval

DEXA – Dual Energy X-ray Absorption

HC – Hip Circumference

IOTF – International Obesity Task Force

SD – Standard Deviation

WC – Waist Circumference

WHCR – Waist-hip Circumference Ratio

WHO – World Health Organization

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Abstract

Introduction and Background:

The prevalence of obesity amongst both the adult and paediatric population has assumed almost epidemic proportions in many developed *and* developing countries. A recent study by the Medical Research Council found that a disturbing 20% of all South African children could be categorized as being obese. Limited data is currently available on the prevalence of obesity in South African children, particularly from the previously disadvantaged population. Given the global epidemic of paediatric obesity, hypertension and type-2-diabetes and the limited available data relating to obese South African children, further studies to enhance the understanding of the risk factors associated with the epidemic are imperative.

Aims and Objectives of the Study: The objectives of the study were to:

1. Determine the prevalence of overweight and obesity amongst learners attending schools in the communities of Belhar, Delft and Mfuleni within the City of Cape Town, South Africa.
2. Determine the prevalence of diabetes and hypertension amongst learners attending school in the communities of Belhar, Delft and Mfuleni in the City of Cape Town.
3. To investigate the association of overweight and obesity with diabetes and hypertension in children and adolescents, and

- To determine the risk factors associated with overweight, obesity, diabetes and hypertension

Sample Population: Excluding learners that did not meet the inclusion criteria, the final sample consisted of 338 learners aged 10 – 16 years attending the government funded primary and secondary schools and residing in the target communities. Girls constituted 195 (57.69%) of the sample and 143 (42.31%) were boys. The sample was recruited from 16 schools in the target communities. Informed written consent was obtained from all participants, their parents, school governing bodies and school principals.

Methods: A repeated measures cross-sectional analytical study was conducted amongst learners from participating schools in the communities of Belhar, Delft and Mfuleni. Three structured questionnaires were administered to all participants. To ensure accurate glucose, cholesterol and triglyceride measurements and diagnosis, participants were requested to fast for a period of 10 hours prior to sampling. Anthropometric measurements, blood pressure measurement and body composition analysis were performed. This was done using tape measure, semi-automatic digital monitor and bioelectrical impedance analysis respectively. Fasting blood glucose, triglyceride and cholesterol concentrations were measured with the aid of the Accutrend GCT glucometer.

Results: Learners had a mean age 12.65 ± 1.85 years. Overweight was found in 28 (8.31%) of the sample, while 10 (2.97%) were obese. Twenty-four (12.31%) of

all girls (195) and four (2.80%) of all boys were overweight. A further 6 (3.09%) of all girls and 4 (2.8%) of all boys were obese.

Amongst the Coloured learners 4 (3.74%) were overweight and another 3 (2.80%) were obese. 12 (8.51%) of the Coloured girls were overweight and 4 (2.84%) were obese. Twelve (23.08%) Black girls were overweight and 2 (3.85%) were obese. Whilst 1 (2.86%) of the Black boys was obese, none were found to be overweight. Black girls were significantly more overweight than their male counterparts. Both overweight and obesity were more common amongst the 16-year-old learners. A statistically significant difference was observed in the prevalence rate of overweight between Black and Coloured learners ($p=0.033$), but not with obesity ($p=0.768$). Nineteen (5.62%) learners presented with elevated blood pressure levels with girls having a higher prevalence than boys (6.15% vs. 4.9%). Elevated blood pressure levels were found in 2 (5.71%) of all Black boys and 3 (5.77%) in girls. Amongst Coloured learners, 5 (4.67%) boys and 9 (6.34%) girls had elevated blood pressure levels. Two (0.59%) of the Coloured learners had elevated blood glucose concentrations. None of the Black learners had elevated blood glucose levels.

Though physical inactivity was found in 9 (60.00%) overweight Black subjects and in only 4 (33.33%) of the overweight Coloured learners, the difference was not significant ($p=0.076$). Girls had significantly higher anthropometric and body composition values compared to boys. Age, gender and waist circumference were

significantly ($p < 0.05$) associated with an increased risk of being overweight. Age and hip circumference were identified as the most significant predictors for obesity. An insignificant association existed between physical inactivity and obesity. A family history of high blood pressure also proved to be protective for elevated blood pressure in the offspring. Diet did not demonstrate any statistically significant relationship with any of the outcome variables ($p > 0.05$).

Conclusion: Based on the national prevalence rates obtained from the 1st South African National Youth Risk Behaviour Survey of 2002, the results of the study suggest that overweight and obesity are prevalent in learners attending school in the Belhar, Delft and Mfuleni areas. Both overweight and obesity is more prevalent in the Coloured males and Black girls in the sample population. No significant differences were observed in the activity patterns of overweight Black and Coloured learners ($p > 0.05$). Age, gender and waist circumference were significantly associated with overweight, while age and increased waist-hip circumference ratio and hip circumference were the most significant predictors of obesity.

An elevated blood pressure level (systolic/diastolic blood pressure $> 85^{\text{th}}$ percentile, but $< 95^{\text{th}}$ percentile) was more common amongst Black girls. A significant relationship existed between elevated blood pressure and waist-hip circumference ratio, hip circumference and body mass index ($p < 0.05$).

Although elevated blood glucose levels were found amongst Coloured learners, none were found to be diabetic.

INTRODUCTION

Obesity can be defined as a generalized and excessive accumulation of body fat in the subcutaneous region, in response to excessive energy storage and decreased energy expenditure.¹ The consequence of childhood obesity is usually not benign, despite the popular belief that overweight children will “outgrow” their physical state. Unfortunately, most obese children continue to be obese as adults.^{2,3}

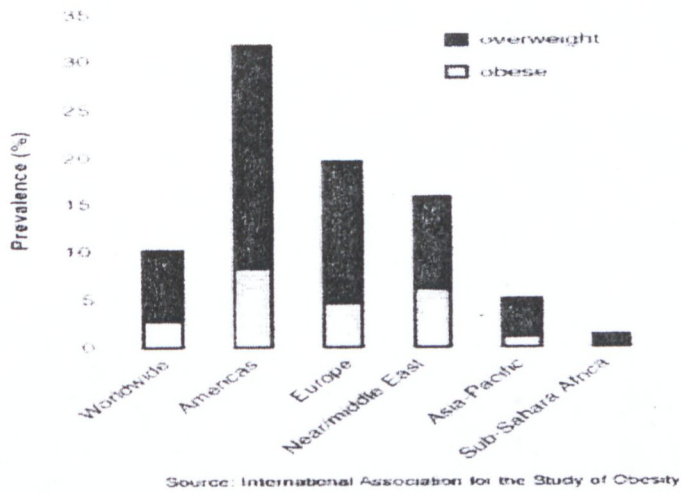
The prevalence of obesity has assumed almost epidemic proportions in many developed *and* developing countries.^{4,5} According to Chopra *et al*⁶, recent reviews reported significant increases in the prevalence of overweight and obese individuals in developing countries. The publication, “The Specialist Forum”, reports that more than one third of the overweight adults in the world today (115 million out of an estimated 300 million people) live in developing countries.⁷ Obesity is thus ceasing to be associated solely with high socio-economic status; instead it is becoming a marker of poverty due to the shift toward highly refined foods and products with high levels of saturated fats in the middle- and lower-income countries.⁶

The prevalence of overweight and obesity, as well as other associated chronic diseases of lifestyle such as chronic heart disease, diabetes, and hypertension, holds significant disadvantages for both the individual and society. Included amongst these are the increased risk of disease and death, the associated health care costs and service utilization, and reduced social status, educational attainments and employment opportunities.^{5,8}

Results of the South African Demographic and Health Survey⁹ conducted in 1998 by the Medical Research Council (MRC) found that approximately 45% of all South Africans (male and female) are above “normal” healthy weight. Of these, 25% were overweight, with a Body Mass Index in excess of 25, while 20% were categorized as obese (Body Mass Index of more than 30). Further results from the survey showed that 29.2% of South African men are overweight (BMI >25 Kg/m² and ≤ 29.9 Kg/m²) or obese (BMI >30 Kg/m²). Almost twice as many South African women (56.6%) fulfilled the overweight and obesity criteria. It is reported in this survey that 9.2% of South African men and 42% of all women displayed abdominal obesity (indicated by a waist-hip-ratio or WHR). In comparison to these results, only 12.2% of South African men and 5.6% of the women were underweight (BMI less than 18.5 Kg/m²). Probably more disturbing and more relevant to this study, is that 20% of all children were categorized as obese.⁹

Results from the first South African National Youth Risk Behaviour Survey (NYRBS)¹⁰ conducted in 2002 demonstrated a national prevalence rate for overweight of 17.2% and 4% for obesity. This survey reported a prevalence rate of 25% for girls and 6.9% for boys, while 5.3% of all girls and 2.2% of all boys could be classified as obese. These results are incorporated in the most recent statistics on the global trends of childhood obesity published by the International Obesity Task Force.¹¹ The findings of this study revealed that 25% of all South African girls aged 13 to 19 were overweight and the boys had a much lower prevalence at 7%. These statistics were similar to prevalence rates reported from the United States of America (30%) and other countries, as illustrated in Figure 1.

Figure 1: The Prevalence of Overweight and Obesity in Various Geographical Regions



Source: International Association for the Study of Obesity (IASO)
The INDY Channel.com (2003)

The aim of this study was to determine the prevalence of overweight, obesity, diabetes and hypertension amongst learners attending schools in the communities of Belhar, Delft and Mfuleni in Cape Town, South Africa, and to determine the risk factors associated with the development of these respective conditions.

OUTLINE OF THE THESIS

Chapter 1 evaluates the problem (childhood overweight and obesity) and its setting, starting with the statement of the problem, sub-problems, hypotheses and objectives. All the inclusion and exclusion criteria relevant to this particular study are outlined in the delimitations and the terms and concepts employed in the document are explained. The assumptions underlying the study are listed and, where necessary, explained. The chapter ends with a brief explanation of the rationale of this study.

In **Chapter 2**, literature on issues pertaining to overweight and obesity are reviewed in order to provide the theoretical framework and scientific basis for the study. This chapter attempts to provide an overview of the global trends observed with regard to the prevalence of overweight and obesity and their associated secondary conditions (hypertension and diabetes), as well as the main health-risk behaviours associated with the aetiology of these conditions. The techniques used for assessing overweight and obesity, as well as the related conditions are also outlined.

Chapter 3 evaluated the type of data used to substantiate data obtained in this study. All validity and reliability issues are discussed and the sampling strategy used for this study is outlined. The initial pilot study is discussed, as well as, each sub-problem and the management, analysis and the interpretation and presentation of that data pertaining the specific sub-problem. This chapter ends with a brief explanation of the procedures for data analysis.

Chapter 4 contains the results of the data collected during this study. In this chapter, the main features and trends in the data are interpreted and described with the aid of graphs

and tables constructed from the descriptive and summary statistics performed on the data. The chapter ends with an outline of the limitations underlying the study.

The discussion of the results are found in **Chapter 5**, and

The conclusion and recommendations, as well as areas for further studies are stated in **Chapter 6**.

CHAPTER 1

THE PROBLEM AND ITS SETTING

1.1 INTRODUCTION

This investigation focuses on determining the prevalence of childhood overweight and obesity in predominantly low socio-economic areas of an urban community of Cape Town. The goal of the research is stated in a clear statement of the problem followed by the specific statements on the sub-problems of interest. Further explorations are presented in the development of specific hypotheses for each formulated sub-problem of interest. Inclusion and exclusion criteria relevant to this study are outlined which provides a solid frame of reference. The section on the delimitations attempts to provide the reader with a more sound comprehension of the terms and concepts employed in this document. The assumptions underlying the study are also explored and presented accordingly. This chapter concludes with a brief explanation of the rationale for this investigation.

1.2 STATEMENT OF THE PROBLEM

The purpose of this study is to determine the prevalence of and the risk factors associated with overweight and obesity amongst learners attending schools in the communities of Belhar, Delft and Mfuleni in the City of Cape Town, with reference to their family health-related history, lifestyle and socio-economic status. In addition, a

further purpose is to examine associations (if any) with diabetes, elevated blood glucose and elevated blood pressure levels respectively.

1.3 STATEMENT OF THE SUB-PROBLEMS

1.3.1 Sub-problem one

The first sub-problem is to measure the anthropometrics profiles and body composition of learners, in order to determine the prevalence of childhood obesity amongst learners aged 10 - 16 years attending schools in the communities of Belhar, Delft and Mfuleni in the City of Cape Town.

1.3.2 Sub-problem two

The second sub-problem is to collate information on the presence of familial risk factors in order to determine whether a family history of obesity, diabetes and/or hypertension predisposes these learners to become obese, diabetic and/or hypertensive in the future.

1.3.3 Sub-problem Three

The third sub-problem is to assess the behavioural, lifestyle and socio-economic status and to analyze, evaluate and interpret the treated data, in order to identify the risk factors associated with overweight and obesity amongst these learners.

1.4 HYPOTHESES FORMULATION

1.4.1 Hypothesis one

1.4.1.1 It is hypothesized that the prevalence of childhood and adolescent obesity will be different amongst the boys and girls in these communities.

1.4.1.2 It is hypothesized that there will be an ethnic differential in the body fat distribution of the participants in the study.

1.4.2 Hypothesis two

It is hypothesized that obesity observed in the learners attending schools in the identified communities will be associated with an increased prevalence of diabetes and hypertension amongst these learners.

1.4.3 Hypothesis three

It is hypothesized that certain risk factors such as physical inactivity, diet, television viewing, ethnicity, gender, age, socio-economic conditions, and area of location (residence), will be associated with overweight, obesity, diabetes or hypertension.

1.5 DELIMITATIONS

Adolescents – The time period between puberty and adulthood, roughly from approximately ages 12 to 21. For the purpose of this study adolescents will be defined as any learner aged 12 to 16 years; while learners aged 10 and 11 will be classified as children.

Adipose Tissue – Tissues consisting of special cells that contain fat.

Anthropometry - “Anthro-“ denotes human beings/bodies. Anthropometry is defined as the measurement of body size, weight, and proportions.

Bioelectrical Impedance Analysis - The principal underlying this method is based on the resistance of adipose tissue to electrical impulses. A minute current is sent through the body via adhesive, disposable electrodes. The adipose tissue in the body resists the current. A machine connected to the electrodes measures the amount of resistance, where it (resistance) is transformed into a measurement value, using the build-in transformation equations.

Black (people) - The preferred term used for most people of African or Caribbean heritage. For the purpose of this study, this term will be used for learners of indigenous African decent (Xhosa, Zulu, Basotho, etc.)

Body Composition - The percentage and mass of the body constituents, such as water, muscle, bone, and fat.

Body Mass Index - Also referred to as BMI. BMI is defined as the weight of an individual (in kilograms) divided by the height in meters squared [BMI = weight

(kg)/height²].

Blood-glucose level - The concentration of glucose in the blood. It is commonly called blood sugar and is usually measured in millimoles per liter (mmol/L).

Blood-glucose meter - A hand-held machine that tests blood-glucose levels. A drop of blood, obtained by pricking a finger, is placed on a small strip that is inserted in the meter, which calculates and displays the blood-glucose level.

Children - For the purpose of this study, the word “children” will refer to learners aged 10 to 11 years.

Cholesterol - A mixture of lipoproteins found in blood, consisting of HDL (high-density lipoproteins), LDL (low-density lipoproteins), and VLDL (very-low-density lipoproteins). Present recommendations are to keep cholesterol levels below 5.2 mmol/l.

Coloured – For the purpose of this study “coloured learners” will refer to learners of mixed ancestry.

Developed Countries – Countries that are technologically advanced, highly urbanized, and wealthy, and have generally evolved through both economic and demographic transitions. Countries with similarly advanced economies and financial markets to the United States are commonly considered as developed countries.

Developing Countries – Countries with a low average income, whose economies are mostly dependent on agriculture and primary resources and the majority of the population, live near the subsistence level. In general, developing countries are not highly industrialized and are dependent on foreign capital and development aid.

Diabetes mellitus - A disease in which the body is unable to use and store glucose normally because of a decrease or lack of insulin production. Diabetes mellitus is usually inherited, but it may be caused by any process that destroys the pancreas (usually the beta cells) or alters the effectiveness of the receptor site on the cell membrane.

Disadvantaged Communities –Communities, which have inadequate resources or facilities such as roads, water system, electricity and absence of natural resources. Based on economic characteristics, communities are characterized as disadvantaged if the average value of property is less than 75% of state average values, the average per capita income for the last 3 years is less than 75% of the national average and in current unemployment is twice the national average for the past 3 years.

Eating Out – For the purpose of this study “eating out” refers to the intake of any food or beverage not prepared and consumed at the individual’s home, but bought from any restaurant or franchise.

Electrodes - An electrode is a conductor used to make contact with a non-metallic part of a circuit, in the case of this study, the human body.

Ethnic – Term used to describe people that are visibly not Caucasian.

Fasting blood glucose - Blood-glucose concentration in the morning before breakfast. Commonly called fasting blood glucose (FBS).

Fat - One of the three main constituents of foods. Fats occur in nearly pure form as liquids or solids, such as oils and margarines, or they may be a component of other foods. Fats may be of animal or vegetable origin and have a higher energy content than

any other food (9 calories per gram).

First-Degree relatives – Refers to the biological parents and all biological brothers and sisters of an individual

Gestational diabetes - A period of abnormal glucose tolerance that occurs during pregnancy, usually controlled by diet and possibly insulin.

Glucose - The simple sugar, also known as dextrose, that is found in the blood and is used by the body for energy.

Glucose intolerant – Based on the internationally recognized WHO criteria, an individuals are classified as being glucose intolerant if they demonstrate a fasting plasma glucose measurement of 6.1 – 6.9 mmol/L.¹²

Hyperglycaemia - A greater-than-normal level of glucose in the blood (high blood glucose). Individuals with a fasting blood-glucose of 6 - 6.9 mmol/L are classified as glucose intolerant while a value greater than 7.0 mmol/l is diagnostic for diabetes.

Hyperlipidaemia - This is an abnormally increased amount of any lipids in the blood.

Hypertension – Based on the guidelines of the World Health Organization, hypertension is defined as a systolic blood pressure >139 mmHg and/or a diastolic blood pressure >89 mmHg in an adult patient who is not receiving antihypertensive treatment and is not acutely ill. In the paediatric population, hypertension is defined as a systolic and/or diastolic blood pressure above the 95th percentile.

Impaired glucose tolerance - A condition that exists when blood-glucose values are elevated above normal but are inconclusive for diabetes. Sometimes erroneously

referred to as borderline diabetes.

Insulin -A hormone (protein) secreted by the beta cells of the Islets of Langerhans in the pancreas for the regulation of blood glucose. Insulin is secreted in response to the detection of an increase in the concentration of glucose in the bloodstream. In addition to promoting the utilization of glucose, insulin stimulates lipogenesis, diminishes lipolysis and increases amino acid transport into cells.

Insulin resistance - A condition in which the body does not properly respond to the action of insulin and thus does not absorb glucose effectively. It is the most common cause of Type-2-diabetes.

Lipometer - A computerized optical system developed in order to permit a non-invasive, quick, precise and safe determination of subcutaneous tissue (SAT).

Non-insulin-dependent diabetes (NIDDM)-Also called Type-2-diabetes. Most people, especially adults over 30 years of age, develop type-2-diabetes rather than a true deficiency of insulin usually found in type-1-diabetes. The onset is gradual, and the symptoms are often minimal. The cells of Type-2-diabetics respond sluggishly to the insulin they make and therefore their cells cannot absorb the sugar molecules well. This leads to blood glucose levels, which are higher than normal. Patients are often overweight. Those with Type-2-diabetes are less prone to acute complications, such as acidosis and coma, than are patients with Type-1-diabetes. Type-2-diabetes is treated through diet alone or through diet plus oral hypoglycaemic agents and or insulin.

Obesity - Obesity is defined as an excessive increase in body fat mass due to an excessive accumulation of fat, resulting in the body weight exceeding the normal weight

by at least twenty (20) percent.

Overweight - Is defined as a body weight (not necessarily excess fat) above some standard of acceptable weight that usually is defined in relation to height.

Parallax - Errors resulting from the difference in the apparent reading of a measurement scale or a skin fold caliper's needle when these are viewed from various points not in a straight line with the eye.

Paediatric – Pertaining to children. Term used in relation to the medical care of children.

Race – A subjective term used to distinguish groups of people but not necessarily to denote biological or physical differences.

Second-degree relatives – Refers to all biological grandparents, uncles and aunts (brothers and sisters of biological parents) of an individual.

Subcutaneous - Underneath ("sub") the skin.

Type-2-diabetes- Refer to Non-insulin dependant diabetes mellitus (NIDDM). Previously called adult diabetes or maturity-onset diabetes in the young (MODY).

Urinalysis (urine tests) -Tests that measure substances in the urine. They provide a general idea of a patient's blood-glucose level several hours before the test. Urine tests for ketones are important for preventing ketoacidosis.

Venous Samples - Samples, normally blood, contained partially or totally in the veins.

1.6 DELIMITATIONS

- 1 The study was limited to public or government funded mainstream schools situated in the Belhar, Delft and Mfuleni communities of Cape Town only, excluding private and special schools.
- 2 The study population consisted of children and adolescents (young adults) aged 10 - 16 years, schooling and residing in the Belhar, Delft and Mfuleni communities. This age group was chosen for practical and physiological reasons. By the age of six, the adiposity rebound occurs; obesity thus has a better predictive value of the adiposity status in later childhood and adulthood.¹³
- 3 A subject was classified as diabetic if the individual had a fasting blood glucose value above 7.0 mmol/L.

1.7 ASSUMPTIONS

The assumptions underlying this study are as follows.

- 1 It is assumed that the responses from the structured questionnaires obtained from the respondents will be a true reflection of their family history.
- 2 After providing the subjects with a typed protocol and a verbal explanation on the process for the collection of urine samples, it is assumed that the participant followed the procedures and that the samples obtained were thus free of external contaminants.

- 3 After having explained the importance of a fasting sample, it is assumed that the subjects did indeed refrain from eating or drinking anything but water during the night, preceding the collection of the urine sample (22h00 until taking of sample).
- 4 It is assumed that the procedures for the calibration of the respective instruments for data collection were valid and the results obtained in the process reliable and accurate.

1.8 THE SIGNIFICANCE OF THE STUDY

Overweight and obesity often has its origins in early childhood. In the study completed by the Medical Research Council 20% of South African children under the age of six were found to be overweight, while recent data suggest that up to 10% of children under the age of 2 years are overweight.⁹ Childhood overweight and obesity are known to have significant impacts on both the physical and psychological aspects of health (wellness). Lauer (as cited by Campbell *et al.*)¹⁴ demonstrated that hyperlipidaemia, hypertension, type-2-diabetes and impaired glucose tolerance occur with increased frequency in obese children and adolescents. Overweight and obese children and adolescents are exposed to a 1.5 to 2 times higher risk of becoming obese adults and of experiencing the chronic health problems commonly associated with adult obesity, such as cardiovascular disease, diabetes, joint and gallbladder disease and premature death.¹⁵ Obese children are often exposed to negative labeling, discrimination, social rejection and isolation, and can develop a distorted body image as early as six years of age.¹⁶ By adolescence, obesity can result in lower self-esteem, and increased rates of sadness, loneliness and nervousness.¹⁶

Both the prevalence of diabetes and hypertension in the South African population has been reported to be high and on the increase, particularly in the previously disadvantaged population groups.⁹ Whilst the global prevalence of obesity in both the adult and paediatric population has been reported to have increased significantly over the last decade, its prevalence in children and its impact and association with particularly type-2-diabetes or hypertension has not been studied extensively. Furthermore, little or no data on overweight South African children, particularly in previously disadvantaged population groups and its subsequent progression to obesity has been reported.

Given the profound consequences of the epidemic of paediatric obesity, and its association with hypertension and type-2-diabetes and the limited data available relating to the wellness of obese children, further studies to enhance the understanding of factors associated with this epidemic are imperative.

CHAPTER 2

REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION

An extensive review of related literature pertaining to overweight and obesity is presented in this chapter. This presentation attempts to provide an overview of the global trends observed regarding the prevalence of overweight and obesity. In addition, it also attempts to elaborate on the main health-risk behaviours (lifestyle) associated with the aetiology of these conditions. Secondary conditions associated with obesity, namely diabetes and hypertension are also evaluated. Screening techniques as an indicator of overweight and obesity, and signs and symptoms of overweight, obesity, as well as the related conditions are outlined. Throughout the review of these screening techniques, specific attention was focused on their advantages and disadvantages. Though all these methods have its own particular value as screening technique, detailed discussions were predominantly limited to the methods employed in this study.

2.2 The Relationship of Overweight versus Obesity

Obesity is a complex, chronic condition that occurs due to an increase in the number of fat cells, or adipocytes in the body. These cells appear early in life when the infant ingests increased calories, which subsequently result in the presence of the potential for increased weight in later years.^{17,18}

The terms overweight and obesity are often used interchangeably, despite the fact that they are not identical.¹⁹ Overweight is an excessive increase in weight (not necessarily excess fat) above a certain standard (ideal weight), based on the height of the individual. Obesity, on the other hand, indicates an increase in fat mass due to an excessive accumulation of fat, resulting in the individual's body weight exceeding the normal weight (ideal weight) by at least twenty (20) percent.²⁰ Unfortunately, no consistent universally accepted criteria for the diagnosis or classification of childhood obesity exists.²¹ Due to the lack of internationally standardised criteria, the assessment of the prevalence of overweight and obesity in children is more difficult than in adults.²²

2.3 The Risk Factors Associated with Overweight and Obesity

Overweight and obesity can be the result of a number of associated factors ranging from chemical imbalances, genetics, to unhealthy lifestyle choices and modern living. The risk factors associated with these conditions include:

2.3.1 Genetics

Genetic factors play an important role in the aetiology of obesity in human beings. Humans have dozens of genes that have been demonstrated to have a direct influence on body mass and size.²³ According to Lansky¹⁸, a child with two obese parents has a 70-80% chance of becoming obese and a child with one parent has a 40-50% chance, while one study demonstrated that parents of normal weight have a 7% chance of having an obese child. Results from the observational analytical cross-sectional study by Mirmiran *et al*²⁴ showed that children of overweight or obese parents are prone to being overweight or obese. Guillaume *et al*²⁵ in their study on familial trends of obesity through

three generations emphasised the influence of strong genetic traits on obesity in a community in the Belgian population.

Compared to the non-obese child, fat cells in obese and the obesity-prone child are thought to respond differently to normal hormonal influences. Another theory suggests that the altered hormonal state in these children results in an increase in fat deposition, or a reduction in fat breakdown.

2.3.2 Interaction Between Genetic and Environmental Factors

Genes are not the only predisposing factor for the development of obesity. Exposure to an over-abundance of high-energy foods may even cause children with “lean” genes to become obese. Research shows that the most susceptible people are those genetically prone individuals who are exposed to excessive food intake.²³ Alternatively, children with obese parents and an obese-prone genetic make-up, who are constantly overfed have a higher risk of becoming obese than persons with no genetic tendency who are not overfed.²⁶

2.3.3. Ethnicity and Social Mobility (Urbanization)

Certain population groups, such as the rural Black population in South Africa, are more inclined to weight gain than others when exposed to a high-fat western diet.²³ This phenomenon has been observed repeatedly when populations exchange their high-fiber, low-fat eating habits for high-fat, high-energy diets as part of urbanization and westernization.²⁷

Children in rural, agricultural communities tend to have low-fat diets based on unrefined

cereals and do a lot of physical work. When these children become city dwellers, they start eating a western high-fat diet and expend less energy. This is confirmed by the findings of LaVelle and Henneberg²⁸ in their study of children living in the city of Cape Town and those living in the distant and poorer rural areas. When the two related groups were compared, the results showed emergent overweight and obesity rates among the Cape Town children compared to the high rates of underweight children in the rural areas. The researchers conclude that the results should be related to environmental factors (urbanization, social status, etc.) rather than to purely economic factors.²⁸

2.3.4 Environmental Factors

Environmental factors associated with obesity include socioeconomic status, race, and region of residence, season, urban living, and being part of a smaller (four or less members) family.²⁹ The improved economic situation of the global society has led to an alarming increase in the consumption of high-energy foods.¹⁹ This has resulted in a general trend of children that live below the poverty line being leaner than children from the more affluent areas.

Seasonal changes and socio-economic status are two very important environmental factors in the aetiology of overweight and obesity particularly through their association with physical inactivity. A lack of physical activity is an important factor in the development of obesity. This inactivity is normally higher during the winter months due to adverse weather conditions. Physical inactivity affects impoverished individuals, as most of them are unable to afford the equipment required for various sporting activities.

2.3.5 Physical Inactivity (Energy Balance)

Obesity can develop when an imbalance exists between energy intake and energy expenditure. Modern children expend much less energy on physical activity than their counterparts of a decade ago.³⁰ The cross-sectional study done by Levitt *et al*³¹, found that over forty percent of historically and socio-politically disadvantaged persons living in urban communities do not participate in any leisure or occupational activities. Since activity counts for approximately one-third of energy expenditure, a sedentary lifestyle may be a major contributor to their weight gain.

Urbanization makes exercise more difficult as private cars and public transport discourages cycling and walking activities. Suburban houses occupy areas that were used to play ball games and other recreational activities. The fear of crime keeps children in their own homes, forcing parents to resort to television and computer games to occupy their offspring.³²

In South Africa, both adults and children alike spent more and more time watching television or surfing the Internet while consuming an ever-growing volumes of “junk-food”.¹ The collaborative study by the Sports Science Institute of South Africa (SSISA) and the Medical Research Council (MRC), found that there was an increased risk of obesity in children who watch television for an extended period of time. One of the findings from the survey of health and fitness conducted by SSISA and MRC amongst 5 000 children aged 12 to 18 was that, based on the data obtained, a projected 35% of these children will be overweight by the age of 18. Television viewing affects energy expenditure and more specifically energy intake by several mechanisms. Foods, and

more often those that are calorie-dense such as chocolates, biscuits and fizzy soft drinks, are heavily advertised on children 's television programmes.³³ Young South African adults and children are thus likely to become increasingly obese over time.¹

2.3.6 Changing Eating Habits (Dietary habits)

Buying snacks such as fried bread from stalls, or low-grade scraps of meat fried in cheap oil is a common practice in the poor urban areas of South Africa.³² The trend of eating more meals at restaurants, buying take-away foods and high-energy snacks, the increase in the availability of kilojoules-laden foods everywhere, large portion sizes and skipping meals due to a lack of time are major contributors to obesity in both children and adults.¹⁵

2.3.7 Psychological Factors

Overweight and obesity can contribute to mental health associated conditions such as low self-esteem and depression, partly due to the discrimination and stigmatization, which overweight people often experience.¹⁶ Studies have shown a significant association between psychological problems - such as feeling of neglect or stress - and the development of overweight and subsequent obesity.³⁴ Many overweight people confess that, to them, food is a source of comfort they turn to when they are experiencing a crisis, or feel stressed or unhappy.³⁴

2.3.8 Low birth weight and Catch-up growth

Catch-up growth is generally considered a physiological adaptation that allows humans and other higher animals to return to their genetically programmed growth trajectory after a period of growth retardation.³⁵ Numerous epidemiological studies have established a

direct association between birth weight, catch-up growth and body mass index (overweight or obesity) attained in later life.^{36,37} These studies suggest that people who were stunted during infancy and childhood, but who subsequently showed catch-up growth, had higher susceptibility for central obesity, impaired glucose tolerance, diabetes and cardiovascular diseases later in life.

Although there is at present no direct evidence for a cause-and-effect relation between catch-up growth and these chronic metabolic diseases, nutritional rehabilitation studies conducted in malnourished infants and children often report excessive fat accumulation or a higher insulin response to a glucose load during catch-up growth.³⁸ According to Crescenzo *et al*³⁵, the most common theory for this phenomenon is based on the impact of an exaggerated compensatory increase in energy intake of energy-dense fatty foods, and on the development of excess adiposity, insulin resistance, hyperinsulinaemia, and an overactive sympathetic nervous system.

2.4 Assessment of Overweight and Obesity

One of the manual methods used to assess childhood obesity is termed **Anthropometrics**. Anthropometry is largely concerned with the study and understanding of human morphological variation.

Measures obtained from anthropometry can be sensitive indicators of health, development and growth in infants and children.³⁹ Anthropometric measures can be used to evaluate nutritional status, whether it is obesity due to over-nutrition or emaciation resulting from protein-energy malnutrition. Anthropometry is also considered the method of choice for estimating body composition in clinical settings.⁴⁰ The

advantages of anthropometry are that the procedures are simple, non-invasive, and can be applied to large samples, the methods used are precise and accurate, and the equipment is relatively inexpensive, durable and portable.⁴¹ Measurement of length, stature (height), weight & head circumference are among the most fundamental and easily obtained anthropometrics measurements.

2.4.1 Height Measurements

Height is considered a key indicator of skeletal growth. For infants and children less than two years old, recumbent length is measured, usually with a wooden measuring board. Children over two years of age and adults are generally measured in the standing position using a stadiometer or portable anthropometer. Height measurements are taken at maximum inspiration, with the examiner's eyes level with the headboard to avoid parallax errors. Height is recorded to the nearest millimeter. In order to increase the validity and reliability of measurements, successive measurements should agree within five millimeters.³⁹

Figure 2.1 Height Measurement (Source: Lohman, Roche & Martorell – Anthropometric standardization reference manual 1988)



2.4.2 Weight Measurement

Weight is the most common measurement for assessing health and nutritional status.⁴⁰ Measurement of weight in children above the age of two years and adults should preferably be done using a beam balance with non-detachable weights. Bathroom scales, although less accurate and reliable, may also be used. Subjects should preferably be in the nude, but if not possible, light clothing should be worn. The time at which the measurements are made should be recorded because diurnal variations in weight may occur.⁴⁰

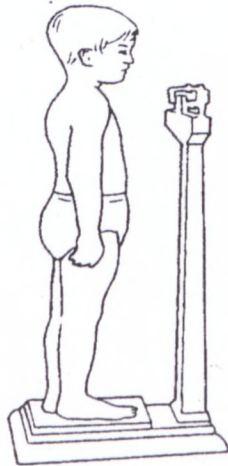


Figure 2.2 Weight measurement (Source: Lohman, Roche & Martorell – Anthropometric standardization reference manual 1988)

2.4.3 Mid-Upper-Arm Circumference

The mid-arm circumference and other related arm circumference measurements are non-invasive, quick and easily obtainable anthropometric measurements. Mid-arm circumference is the circumference of the upper arms at the triceps skin fold site. These measurements are used in equations for the calculation of arm muscle area (bulk) and

estimated body weight.⁴⁰

2.4.4 Waist Circumference

James *et al*⁴² stated that studies have demonstrated waist circumference is a useful, albeit crude, measure of increased intra-abdominal fat, with an enhanced risk for conditions such as cardiovascular diseases. In their report, The World Health Organization (WHO)⁴³ suggested gender-specific cut-off points for waist circumference, which not only crudely predicted overweight or obesity for individuals, but also signified their propensity to hypertension and lipid disorders. The cut-off for males was established as a waist circumference >94 centimetres and for girls >80 centimetres.⁴³



Figure 2.3 Waist circumference measurement (Source: Lohman, Roche & Martorell – Anthropometric standardization reference manual 1988)

2.4.5 Body Composition Analysis (BIA)

Body composition analysis implies the determination of the body's lean and fat weight, which together make up the total body weight. Lean weight is defined as: everything that is not fat, and as such, include the skeleton, muscles, viscera (brain, heart, liver,

intestines) and total body water content. The procedure for BIA is outlined later in this chapter.

2.4.5.1 Body Composition Measurements

The assessment of percentage body fat in children is not an easy task, for several reasons. First, the chemical composition of the fat-free mass in children is different from that in the adults in whom carcass analyses were performed, and second, the chemical composition changes during maturation.⁴⁴ A variety of methods have been developed over the years, each with its advantages and limitations. No single method can fulfill all of the criteria for the “ideal” body measurement technique. They are all based on certain assumptions (that the thickness of the subcutaneous adipose tissue reflects a constant proportion of the total body fat, and the skin fold sites selected for measures represent the average thickness of the entire subcutaneous adipose tissue)⁴⁵, which are not necessarily valid in all population groups.⁴⁶ The methods for body composition analysis include:

2.4.5.1.1 Hydrostatic Weighing (Densitometry)

This is also known as underwater weighing. It is often regarded as the “gold standard” of body composition analysis. However, this method, involves the immersion of a subject in an underwater tank, is highly technical, time consuming and requires considerable subject co-operation.⁴⁶ In recent years even more complex and expensive methods such as Dual Energy X-ray Absorptiometry (DEXA) scanning and Magnetic Resonance Imaging (MRI) are being recognized amongst researchers as also being accurate methods of body composition assessment.⁴⁶

2.4.5.1.2 Skin fold Calipers and Skin fold measurements

The usual method of indirectly estimating percent body fat in clinical settings is to measure skin folds. Skin fold calipers, sometimes referred to as fat fold thickness, has been the most frequently and most widely used method for measuring subcutaneous adipose tissue thickness. This method involves the use of a caliper device to “pinch” the skin at a number of predetermined sites on the body and is widely used and validated. A regression equation is used to convert the measurements to a percentage body fat reading.

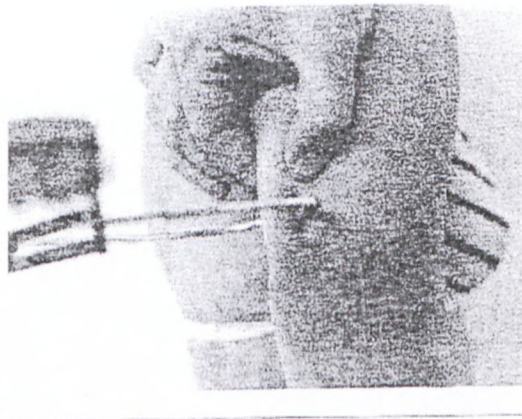


Figure 2.4 Tricep skinfold measurements (Source: Lohman, Roche & Martorell – Anthropometric standardization reference manual 1988)

Subcutaneous fat is not uniformly distributed throughout the body. It is thus vital to select skin fold sites, which are most representative of the whole subcutaneous fat layer. Sites commonly used for skin fold measurements include the triceps skin fold, biceps skin fold, sub-scapular skin fold, supra-iliac skin fold, and the mid-axillary skin fold. Roche et al. (as cited by Gibson)⁴⁷ emphasised that the most appropriate skin fold sites depends on whether total body fat or percentage body fat is the parameter of interest. These

researchers found that the triceps skin fold provided the best estimate of body (%) fat in children and adult women, but not in adult men. On the other hand, sub-scapular skin fold was recommended when estimating total body fat in boys. For assessment of total body fat in girls and adults, no single skin fold measurement was regarded as adequate; instead Body Mass Index (BMI) was preferred because the adult BMI values for overweight and obesity correspond to the 80th and 95th percentiles of the US National Center for Health Statistics reference values for children.^{47,48}

As no single body region appears to have skin fold sites which are consistently representative of the whole subcutaneous fat layer, several ratios have been used to assess the relative distribution of subcutaneous fat in children, youth, and adults.^{47,49} Ratios of trunk to extremity skin folds are used to indicate central versus peripheral patterns of subcutaneous fat distribution. Skin folds are used either singly, for example, the ratio of the sub-scapular to the triceps skin fold, or in combination, for example, the ratio of the sum of three trunk skin folds to the sum of three extremity skin folds.⁴⁷ In general when studying both children and adults, investigators recommend taking one limb skin fold (left triceps) and one body skin fold measurement (left scapular) to account for the differing distributions of subcutaneous fat. Skin fold (thickness) measurements do not measure total body fat mass or its percentage directly but rely on validated equations that describe the relationship between measures of skin fold fat as well as other body dimensions and the measured body density. One of the most common equations used is that of Durnin and Womersley.⁵⁰ The minimum triceps skin fold thickness indicating obesity in the different age groups are: in age 5 - 9, 12 in males and 14 in girls; in age 10 - 14, 16 in males and 20 in girls; age 15 - 19, 16 in males and 24 in girls; age 20 - 24, 16

in males and 28 in girls; age 25 - 29, 20 in males and 29 in girls; and in the age group 30 - 50, 23 in males and 30 in girls, as suggested by Suitor and Hunter.⁵¹

These skin fold measurements thus require the skill of highly trained operators, and the reproducibility of successive measurements on the same subject is suspect if different operators do the testing. Also of concern, especially in the obese population, is the compression of fat by the caliper due to variances in fat density. It is therefore almost impossible to obtain accurate measurements in the obese population.⁴⁶ To improve the accuracy of skin fold caliper measurements, several authors have performed log transformations on the skin fold values obtained.⁵²

2.4.5.1.3 Infrared Interactance

This technique is based on the fact that the ability of a body tissue to absorb and reflect infrared light depends on its composition. A "wand" device (fibre-optic probe) is placed on the biceps with an infrared light beam directed through the underlying tissues. The unit receives the refracted beam and calculates the amount of fat and muscle under the tissue. Although the test is quick to perform, the accuracy of the technique and its reproducibility is not well established.

2.4.5.1.4 Bioelectrical Impedance Analysis (BIA)

This is a safe, portable non-invasive and inexpensive method of determining body composition.⁵² Bioelectrical impedance analysis (BIA) is based upon the relationship between the volume of the conductor, the conductor's length, the components of the conductor and its impedance. The physical principle behind the BIA method is that the body's lean compartment, comprising approximately 73% electrolytic water, conducts

electricity far better than the body's fat compartment, which is very low in body water content (5-10%). These two compartments have, therefore, very different resistance (impedance values) to a high frequency electrical current. A minute current is sent through the supine body via electrodes attached to the right foot and hand. No special skill and little training are necessary to administer the assessment and it is non-threatening. This makes it especially useful in assessing body composition in the paediatric population.⁵³ Some of the limitations of this method are that the equipment is relatively expensive and, because bioelectrical impedance measures the body water's resistance to the current, the impedance measurement is affected by body hydration status, body temperature, food intake, menstrual cycle stage and time of day. It therefore requires well-controlled conditions to get accurate and reliable measurements.

In recent years, the examination of human body composition has grown in its use and importance in such fields as medicine, physiology, fitness assessment, sports and nutrition. During weight-loss programs, body composition assessment monitors lean body mass, doctors use it for screening purposes and to monitor the hydration status of patients in intensive care and burn units.

2.5 Conceptualisation and Operationalisation of Obesity and Overweight

2.5.1 Power Indices

Indices are ratios constructed from two or more raw anthropometric measurements (for example, height, weight and circumferences), or various combinations such as weight for age and height for age.

2.5.1.1 Weight-for-height

This index is a sensitive index of current nutritional status. Stature is nearly independent of age only between the ages of one year and puberty.⁵⁴ Weight-for-height percentiles thus only apply to prepubescent children. Due to its relative independence of age between one and ten years, this index is useful in areas where the ages of children are uncertain. Limitations of this index are that oedema may complicate the interpretation of weight-for-height measurements; furthermore, it classifies children with poor linear growth as “normal”.⁴⁷ It is thus preferable in some cases to use this index in combination with height-for-age.

2.5.1.2 Height-for-age

Height-for-age is typically used as an index for stunting.^{47,51} In contrast with weight-for-height, height-for-age can be used as an index of the nutritional status of population groups as it estimates past and chronic nutritional status. Deficits in height take a relatively long time period to develop. Assessment of nutritional and health status based on height-for-age alone may result in an underestimation of malnutrition in infants.^{47,51} Possible genetic and ethnic differences also affect the validity of evaluating height-for-age.

2.5.1.3 Body Mass Index or Weight/(Height)² Ratio

According to Willet⁵⁵, weight and height are the most commonly available anthropometric measurements in epidemiological settings. Body Mass Index (BMI) is calculated as weight (kg) divided by the height squared (m²). Because all the power-type indices are body mass indices, the more technically correct name for W/H² is the

Quetelet's index. Quetelet's Index is obtained by dividing weight in kilograms by height in metres squared.⁵⁵

Not everyone agrees on the suitability, validity and reliability of Body Mass Index as an index of fatness in children and adolescents.⁵⁶ This is due to the fact that, in contrast to adults, Body Mass Index varies substantially by age and gender during childhood and adolescence.⁵⁶ Cut-off points for children and adolescents should be gender- and age specific. The Center for Disease Control (CDC)⁵⁷ suggests BMI-for-age for the screening of children aged two to twenty years for overweight. However, support for using Body Mass Index (BMI) to measure childhood obesity is rapidly increasing within the international scientific community.^{19,22,24,58} The study by Goran *et al*⁵⁹ also successfully demonstrated that the measurement of BMI in children show a good correlation with body fat percentage. The study by Frisancho and Flegel (as cited by Lee and Niemann)³⁹ have shown Quetelet's Index to correlate well with estimates of body fatness based on skin fold measurements, and they recommend combining Quetelet's Index with skin fold measurements whenever possible. Investigators have suggested combining Quetelet's Index with waist-hip ratio (WHR) as an improved means of assessing risk for heart diseases, stroke, diabetes mellitus, and premature death.

2.5.1.4 The Waist-Hip-Circumference Ratio

The location of accumulation of excess body fat is significant for health reasons. An excessive accumulation in the abdominal area relative to the extremities exposes an individual to a higher risk for conditions such as heart disease, diabetes and other metabolic disorders. The waist-hip-circumference ratio is a simple method for describing

the distribution of both subcutaneous and intra-abdominal adipose tissue.⁶⁰ Measuring the waist and hip circumferences, and then dividing the waist measurement by the hip measurement mathematically calculates this.

The ratio of waist to hip circumferences attempts to distinguish “upper body” versus “lower body” fat accumulation in adults. Changes of waist-hip circumference ratio with age are not yet known. Jones *et al*⁶¹, measured waist-hip ratio in a semi-random, stratified sample of 4349 British Caucasian men aged twenty to sixty-four years. They noted that the ratio increased with age (curvilinearly) and excessive weight, both separately and in combination. The result of computer tomography scans in 28 women showed a high degree of correlation between the waist-hip ratio and the proportion of fat situated intra-abdominally at the umbilical level.⁶²

There is little agreement on the best power-type index for assessing obesity, especially in adults, or on the basis on which a selection should be made.

2.6 Reference Data For Classification of Overweight and Obesity

Anthropometric reference data are used for assessment of the frequency of protein-energy malnutrition or obesity in communities and the diagnosis of individuals by single or multiple measurements.⁶³ Reference data may be derived from local reference data or internationally available values. Local reference data should be compiled from measurement of well fed, medically and socially protected children selected from a local elite group that is ethnically and genetically representative of the study population.

The use of local reference data in developing or less developed countries is strongly

criticized. The argument against using such data is that populations from less developed regions often experience growth deficits resulting from poor nutrition and health.⁶³ An international reference for the definition and classification of overweight and obesity would allow appropriate comparisons across studies and monitoring the global problem of obesity. Since the data met most of the criteria for ideal reference data, the World Health Organization (WHO) has recommended the National Center for Health Statistics (NCHS) reference growth data as an international standard for the comparison of health and nutritional status of children among countries.⁵⁴ The NCHS data were derived from the various sources: the longitudinal study by the Fels Research Institute for ages zero to thirty-six months, the Health Examination Survey (HES) Cycle I for ages six to eleven years, and the first National Health and Nutrition Examination Survey (NHANES I) for ages two to seventeen years.

Another international reference that is recommended is the International Obesity Task Force (IOTF). The IOTF reference is a series of gender-age-specific Body Mass index cut-offs. This reference data is based on large data sets from six countries or regions (Brazil, Britain, Hong Kong, the Netherlands, Singapore and the USA) and the BMI cut-offs are linked to the adult cut-offs for overweight and obesity.^{13,19,56} Currently, little or no South African reference data for childhood overweight and obesity exists, which consequently influence comparability adversely.⁶³

2.7 Nutrition and Obesity

Nutritional adequacy is essential to good health and is the basis for the function and growth of every cell in the human body. Comparison of the nutrient content of an

individual's diet with the Recommended Daily Allowance (RDA) is normally performed either by a skilled dietician or computer analyses. While such comparisons cannot be used as evidence that an individual is over-nourished (malnourished), it can be used as an indicator that a population may be at risk of being over-nourished.⁶⁴

One technique of detecting nutrient excesses early, is by means of recording the foods consumed. In the twenty-four hour recall method, the subject recounts everything eaten or drunk within the past twenty-four hours. Though this method does not provide enough accurate information for generalizations about an individual's usual food intake or may not truly reflect a person's usual intake, it is easy to obtain and less frustrating to analyze.

A further technique to determine how often an individual eats a specific type of food per day, week, month or year, is the food frequency checklist. Information gathered from this list can help pinpoint nutrients that may be excessive or deficient in the diet. Used in conjunction with the twenty-four hour recall, the food frequency checklist record allows double-checking the accuracy of the nutrient information obtained.⁵⁴

2.8 Obesity and Disease

Many chronic and potentially fatal diseases are all linked to obesity.⁶⁵ Obese individuals have an increased risk for various health related problems. Included amongst these are colorectal, breast, cervical and prostate cancer, abnormalities in the reproductive function, low back pain, possible influence on foetal development, coronary heart disease, osteoarthritis, gall bladder disease, sleep apnoea, lipid disorders, hypertension, impaired glucose tolerance, and type-2-diabetes.⁶⁶

The study by Pi-Sunyer (as cited by Gidding et al)⁶⁷ concluded that obesity is strongly linked to cardiovascular disease and non-insulin-dependent diabetes mellitus through the promotion of insulin resistance and other associated physiological abnormalities, including dyslipidaemia, elevated blood pressure, and increased left ventricular mass.

2.8.1 Obesity and Cancer

Being heavy or overweight increases the risk of developing cancer. Calle *et al*⁶⁸ conducted a prospective study to determine the relation between body-mass index and the risk of death from cancer at specific sites. The results from this cohort study successfully demonstrated that increased body weight was significantly associated with increased death rates for all cancers combined and for cancers at multiple sites.

Excess body fat cells produces increased levels of insulin and excess oestrogen. Cells in the human body divide and replicate more rapidly when they are exposed to increased amounts of insulin and oestrogen. The rapid increase in more cell divisions (mitoses) increases the risk of mutases (abnormal development) during one of these cell divisions and the cells could become cancerous. The additional hormones (insulin and oestrogen) lead to the rapid reproduction of the cancer cells. Fat cells also trap carcinogens (cancer-causing agents) in the body, which can lead to the development of cancer.⁶⁹

2.8.2 Obesity and Diabetes Mellitus

Insulin sensitivity and insulin response (resistance) are major components of the pathophysiology related to obesity and type-2-diabetes. Obese children have a higher prevalence of insulin resistance and type-2-diabetes.⁷⁰

Insulin resistance is the diminished effectiveness of insulin in lowering blood glucose (glucose) levels and is common to the clinical syndromes of obesity, hypertension, and atherosclerosis.⁷¹ Once the cells have become resistant to insulin, blood glucose levels stay elevated and the body responds by producing more insulin, provoking yet greater intolerance in response to the elevated insulin levels that is then present in the blood. Type-2-diabetes results when the pancreas can no longer maintain this level of insulin production.⁷² The exact cause of this phenomenon is unknown but numerous changes in organ and cell function contribute to insulin resistance.

Certain ethnic groups (in both the adult and paediatric populations) are more likely to develop insulin resistance and glucose intolerance than others.⁷³ While research amongst adults have shown that African-Americans have a higher fasting insulin concentration and lower insulin sensitivity than whites^{74,75}, these racial differences have also been noted in children and adolescents in various other studies. The study of Ching-Yi *et al*⁷³ demonstrated that African-American children had lower insulin sensitivity and higher acute insulin response than White children. Schuster *et al*⁷⁶ evaluated White and African-American lean and obese adolescents; within racial groups, the obese adolescents had an increased insulin response during the oral and intravenous tolerance tests. Obesity also seemed to have a greater effect on insulin resistance in African-American adolescents than white adolescents. Recent evidence suggests that the African, Asian and Coloured populations of South Africa are at an increased risk of developing diabetes with particularly type-2-diabetes taking on epidemic proportions.⁹ Many inherited and acquired factors can affect insulin sensitivity. Some of these, gender for example, are immutable (unalterable). However, associated factors such as regional

adiposity, skeletal muscle mass, and level of physical conditioning are potentially modifiable.⁷⁷ Hormonal changes associated with puberty and pregnancy (second and third trimesters) often lead to substantial increases in insulin requirements of the body.⁷⁷ Results of the study by Sinha *et al*⁷⁸ showed that risk factors associated with impaired glucose tolerance include insulin resistance, marked hyper-insulinaemia both after fasting and after a glucose challenge, and hyper-proinsulinaemia after fasting. The results also suggested that fasting hyperglycaemia is indicative of a more advanced stage of clinical diabetes, and the determination of its presence represents a very sensitive method for detecting impaired glucose tolerance.⁷⁸

The role of body fat distribution in insulin resistance is important. The key may be abdominal fat (visceral and subcutaneous fat), which is highly correlated with insulin resistance. Upper body (android) obesity and, in particular, visceral fat deposition (indicated by a high waist-hip ratio) is more closely associated with glucose intolerance and other features of the insulin resistance syndrome than lower body (gynaecoid) obesity.⁷⁹ Data in the study of Tershakovec *et al*⁸⁰ suggested that visceral abdominal fat is associated with insulin resistance in African-American individuals. Results from the study done by Lovejoy *et al*⁸¹ amongst 37 African-American and 22 Caucasian women suggested that the relationship between body fat distributions might be different in African-Americans and Caucasians. In individuals with insulin resistance, the distribution of fat deposits becomes more noticeable around the stomach area. The waist-hip ratio results in the classic “apple shape” versus the “pear shape”, and is considered a red flag.⁸² A family history of diabetes and heart disease, a high body mass index, elevated blood pressure, high levels of blood fats (triglycerides), low concentrations of high-

density lipoproteins, and insulin resistance are all potential signs which are identified as guidelines for identifying people at risk.⁸³

Type-1-diabetes occurs equally among males and girls, but is more common in caucasians than non-caucasians. Data from the World Health Organization's Multinational Project for Childhood Diabetes indicated that type-1-diabetes is rare in most children within the African, American Indian, and Asian populations.⁸³ However, some northern European countries, including Finland and Sweden, have high rates of type-1-diabetes. The reasons for these differences are unknown.

Type-2-diabetes is more common in older people, especially in people who are overweight. Intra-abdominal visceral fat is associated with peripheral and hepatic insulin resistance in both men and women with type-2-diabetes mellitus. Subcutaneous adipose tissue is also associated with peripheral and hepatic insulin resistance in male, but not female, type-2-diabetics. Men and women show similar degrees of deep subcutaneous and visceral fat. Women have greater superficial subcutaneous fat than men.⁸⁴

2.8.3 Obesity and Hypertension

A family history of hypertension and obesity are both risk factors for hypertension in the offspring.⁸⁵ In addition to this, hypertension and obesity share several physiopathological abnormalities and are increasingly more frequently associated with each other. According to Krauss *et al*²³, hypertension is one of the most profound effects of obesity on cardiovascular health and disease. Risk estimates from population their studies suggested that >75% of hypertension could be directly attributed to obesity.⁸⁵ It is well documented that blood pressure increases with weight gain and decreases with weight

documented that blood pressure increases with weight gain and decreases with weight loss.^{86,87} Results from the Bogalusa Heart Study⁸⁸ revealed that obese children were 2.4% more likely to have higher diastolic blood pressures and 4.5% more likely to have higher systolic blood pressures, compared to children of average weight. High blood pressure is a major risk factor for heart disease and the chief risk factor for stroke and heart failure, which in turn can also lead to kidney damage.^{87,88} Krauss²³ continues to state that the risk factors for heart disease, such as high cholesterol and high blood pressure, occur with increased frequency in overweight children and adolescents compared to those with a normal weight for height and age.

The prevalence of hypertension differs among racial and ethnic groups.^{89,90} Compared to the general population in America, the African-Americans have the highest prevalence, while blood pressure in the Hispanics is lower than that of non-Hispanic whites. Data from the World Health Organization (WHO) and the Joint National Committee (JNC) indicates that increasing hypertension prevalence trends have been observed in South Africans, particularly in the African indigenous population particularly over the last decade.⁹¹

Obesity has a strong effect on lipoprotein metabolism, regardless of ethnic groups involved. Lipoproteins are a combination of varying amounts of fats and proteins. Increased weight is a determinant of higher levels of triglycerides (TG), elevated low-density lipoprotein-cholesterol (LDL), and low high-density lipoprotein-cholesterol (HDL).⁹² Cholesterol is a waxy, fat-like substance found in body cells of humans and animals. Blood cholesterol is a natural part of the human blood fats, where the liver manufactures approximately 80% of blood cholesterol and the remaining 20% come

Sometimes cholesterol is referred to as "good" cholesterol and "bad" cholesterol. These descriptions actually refer to the substances called lipoproteins that carry cholesterol throughout the body in the bloodstream.

"Good" cholesterol is associated with high-density lipoproteins (HDLs). HDLs are durable fat-carrying protein compounds that are believed to remove excess cholesterol from the body. Higher levels of HDLs are therefore believed to be associated with lower rates of heart disease (a value of 1.80 has 1/2 the average risk of a heart attack).⁹⁴

"Bad" cholesterol is associated with low-density lipoproteins (LDLs). Low-density lipoproteins carry cholesterol in the blood to body cells. High levels of LDLs are usually associated with elevated blood cholesterol and an increased risk of heart disease due to cholesterol and fat being deposited in the arteries. These fatty deposits decrease the interior size of the arteries (atherosclerosis), resulting in the reduction of the blood supply, and thus increasing the risk of heart disease and stroke.⁹³ One report from the Bogalusa Heart Study indicated that a high childhood blood level of cholesterol was the most consistent and independent predictor of carotid intima-media thickness (increased thickness of the carotid artery).⁹³

Triglycerides are another type of fat found in the blood and body tissues. They are manufactured in the liver when excess calories are consumed from sugar, fat, and alcohol. Calories not utilized immediately by body tissues are converted to triglycerides and transported to fat cells for storage. Ideal blood triglyceride levels are levels < 2.3 mmol/L.

Much controversy exists about fat, cholesterol and heart disease. Some medical experts

believe that consumption of high levels of saturated fat and cholesterol lead to high blood cholesterol and, in turn, to an increased risk of heart disease. Yet, other experts state that there is still no proof that reducing consumption of cholesterol will effectively reduce the incidence of heart disease. Other factors that have been strongly implicated in heart disease are stress, high blood pressure, smoking, obesity, diabetes, and a family history of heart disease.

2.8.3.1 Hypertension and Children

Essential hypertension in children is associated with a higher incidence of secondary causes than in adults. However, in the last decade, studies have shown an increase in the incidence of essential hypertension in the paediatric population, especially among adolescents. The increasing epidemic of obesity is considered to be the most important etiological factor for essential hypertension in children.⁹⁵ Obese children have an approximately 3-fold increased risk for hypertension than non-obese children.⁹⁶ This is supported by the results from the study by Adams⁸⁸ suggesting that the average blood pressure levels are on the rise amongst the youth of America, corresponding with the increasing prevalence of overweight and obesity amongst that population. The prevalence of hypertension varies with geographical locations. Based on reports of the 1996 Task Force, Stephens and Dillon⁹⁷ quoted the prevalence of childhood hypertension in the United Kingdom to be between 1 and 3%, compared to the 13% reported in children from Quebec.

2.9 Physical Activity and Obesity

Chronic disease risk factors, including a sedentary lifestyle, may present it even in young children. Accurate assessment of physical activity in children is necessary to identify current levels of activity and to evaluate the effectiveness of intervention programmes designed to increase physical activity.⁹⁸ It is also important for researchers and practitioners interested in the surveillance and screening for the exposure of interest.⁹⁹

2.10 ASSESSMENT OF THE VARIOUS CONDITIONS ASSOCIATED WITH OVERWEIGHT AND OBESITY

2.10.1 Measurement of blood glucose and diagnosis of diabetes

Special tests are employed in the diagnosis of diabetes and the associated pre-diabetic conditions. A number of laboratory and commercial tests are available for both the screening, diagnosis and monitoring of blood glucose levels. Current methods of blood glucose measurement and monitoring require a blood sample. Blood glucose (sugar) monitoring can be done with a variety of portable devices. Commercial methods currently available include:

2.10.1.1 Commercial Devices

Commercially patented devices, particularly those used for the monitoring of blood glucose include the Minimed[®] continuous glucose monitoring system, The Accutrend[®] glucometer and the Cygnus[®] glucoWatch biographer.

2.10.1.1.1 The Finger prick Test – Screening Method

The finger prick test is a semi-invasive method, which is done with a lancet or a spring-loaded device fitted with a lancet that punctures the fingertip quickly. A suspended drop of blood is then allowed to form. The drop of blood is placed on a treated testing strip, which in turn is placed in a blood glucose monitor (for example the Accutrend glucose meter, also called glucometers) that reads the blood glucose level. Glucometers use an enzyme - glucose oxidase or hexokinase - that reacts with the glucose in the drop of blood on the strip.¹⁰⁰ The reaction may produce a colour change, which the meter translates into a numerical reading (the blood glucose level). Equipment currently available may have a mean imprecision of <5%, while the coefficient of variance could be as low as 3.7%. The detection limit for the Accutrend glucometer has been shown for the range 1.1 - 33.3 mmol/L. Researchers are also exploring new technologies for glucose testing that avoids the traditional and often-unpleasant finger prick.

2.10.1.2 Fasting Plasma Glucose Test from Venous Blood Sampling

Venous blood is preferred for most haematological examinations and assays as it yields the most accurate and reliable results.¹⁰¹ Fasting Plasma or serum glucose can be determined by means of a highly sensitive automated analyzer for a quantitative assessment of diabetes. This facilitates the accurate diagnosis and classification of diabetes.

2.10.1.3 The Oral Glucose Tolerance Test

The Oral Glucose Tolerance Test (OGTT) is performed to confirm a diagnosis of diabetes mellitus, gestational diabetes and other metabolic diseases. Because the OGTT is a more sensitive test than the fasting plasma glucose test, and involves

multiple blood draws to monitor insulin production, it can often detect cases of mild diabetes that may be missed by the fasting test. For an Oral Glucose Tolerance Test, the individual fasts for 10 to 14 hours prior to the start of the test. A blood sample is first taken before the person consumes a beverage containing 75 grams glucose. Blood is then drawn every half hour for 2 hours. This is most often drawn from a vein in the forearm or hand. In normal glucose tolerance, blood glucose rises no higher than 7.8 mmol/L 2 hours after the drink.

In impaired glucose tolerance (IGT), or pre-diabetes, the 2-hour blood glucose is between 7.8 and 10 mmol/L. If the 2-hour blood glucose rises to 11.1 mmol/L or above, a person has diabetes. Glucose levels that quickly rise above normal levels (i.e., 11.1 mmol/L or higher) and take longer to normalize usually indicate diabetes mellitus. In some cases, urine samples may also be examined for the presence of glucose (termed as glucosuria). Samples of midstream urine- that is, not at the beginning and not at the end-are collected at the same time intervals as the blood samples are taken. On average, normal glucose levels typically peak at 8.9 - 10 mmol/L from 30 minutes to 1 hour after administration of the oral glucose dose, and should then return to fasting levels of 7.8 or less within a 2 to 3 hour period. Factors such as age, weight, and race, as well as recent illnesses and certain medications can influence results. More recently, the American Diabetes Association has recommended that the fasting blood glucose level >7.0 mmol/L is adequate to confirm a diagnosis of diabetes mellitus.

2.10.1.4 The Urinalysis

This easily and painlessly obtained specimen provides insight into patients' overall health and specific and critical information regarding kidney function, urinary tract infection, pregnancy and diabetes. Both automated and manual testing protocols are available and are designed to be simple, requiring minimal experience. The measurement of urinary glucose used to be the most important method of obtaining glucose values.

There are three major drawbacks of urinary glucose testing compared to whole blood testing. Firstly, urine glucose tests will not provide information about very low glucose levels (since at lower levels glucose does not enter the urine). Secondly, urine glucose readings change when the volume of the urine changes. Thirdly, urine glucose level is more of an average value than the blood glucose level. Results obtained from the urinalysis are also influenced by an individual's kidney function.

2.10.2 The Assessment of Physical Activity

Physical activity has traditionally been measured with surveys and recall instruments, but these techniques present problems in a paediatric population that has difficulty in recalling such information. Other tools used to assess physical activity including the "doubly water labeled water technique" and indirect calorimetry which are considered the preferred methods. Alternative devices such as heart rate monitors, pedometers and accelerometers are also increasingly becoming popular measurement tools for physical activity.¹⁰² These devices reduce the subjectivity inherent in survey methods and can be

used in large groups of individuals.¹⁰³ The study by *Metcalf et al*¹⁰⁴, established that the accelerometer is a credible tool for the assessment of habitual inactivity and a feasibility activity monitor. It is well tolerated and generates quality data from a high proportion of children.

2.10.3 Assessment of Hypertension

It is widely suggested that, prior to any examinations, an antenatal history should be obtained as this often provide a good indication of the cause of hypertension of children. Accurate and reliable measurement of blood pressure is essential in the determination of early hypertensive disease. Since children grow at varying rates, adjustments are required when interpreting blood pressure percentiles for individuals. The results from the study by *Burke et al*¹⁰⁵ emphasised the importance of both adequate training of observers and the use of replicate blood pressure measurements to ensure optimal accuracy of measurements.

2.10.3.1 The Cuff

The cuff is a very significant element in the measurement of arterial blood pressure. The width of the cuff is of primary importance in the measurement of the blood pressure and must thus be adapted to the circumference of the arm, as mistakes can occur if an unsuited cuff is used. Various cuff sizes exists: a small size for children, a normal size for the adults, and a large one for the subjects with a large arm. The width of the cuff for a child, an adult and obese patients are respectively 9, 12 and 15 centimeters.

The photoplethysmographic method measures the blood pressure at the level of the arteries of the fingers. A small cuff is inflated around the finger, and the pressure is

maintained constant in the small cuff. Any variation of pressure on the level of the finger will involve a modification of the pressure in the cuff, which thus translates it into blood pressure.

2.10.3.2 The Sphygmomanometer

The sphygmomanometer with mercury has a mercury column, which allows the reading of blood pressure in millimeter of mercury (mmHg). Up to now, this technique has been the basic method for measuring blood pressure. The results obtained are highly reliable in the long run, but the use of mercury will soon be prohibited within the European Community.¹⁰⁶ The mercury sphygmomanometer is exclusively reserved for the measurement of the blood pressure at the level of the arm.

The aneroid sphygmomanometer does not contain mercury. A metal membrane located in a case translates the blood pressure transmitted by the cuff. This type of device is very practical to use and is generally reliable if it is regularly controlled. This method constitutes a good alternative to the sphygmomanometer with mercury, which might be abandoned in a few years. The device can produce blood pressure at the level of the arm, but also at the level of the wrist or the finger.

2.10.2.3 Digital Devices

The use of automatic devices to measure blood pressure has several advantages: it provides more numerous measurements, measurements can be taken in a more relaxed setting than in the physicians office or outpatients clinic, and it allows health care workers to perform other tasks while the blood pressure is being measured as it does not require a medically trained person to operate it.¹⁰⁷

The study by Stander *et al*¹⁰⁷, compared blood pressure measurements obtained using three different electronic devices with the manual method (standard mercury sphygmomanometer). Results from their study demonstrated that measurement made by certain digital devices correlate closely with the manual mercury sphygmomanometer technique. The use of electronic devices is thus useful and valid in epidemiological surveys.¹⁰⁷

2.11 SUMMARY

The review of the related literature pertaining to obesity and overweight provided the theoretical framework and scientific basis for this study. An extensive review of the related literature revealed that childhood overweight and obesity are currently experiencing a rapidly increasing trend globally. Various risk factors such as genetics, environmental factors (low household index, area of location, physical inactivity, ethnicity, urbanization, changing eating habits), and psychological factors play a vital role in the development of overweight and ultimately obesity. Numerous methods/techniques (indices, mathematical equations and instruments), all with their inherent advantages and disadvantages are currently employed for the assessment of childhood and adulthood obesity.

The use of local reference data for overweight and obesity in developing countries is highly criticised within the scientific community. The lack of sufficient local reference data for overweight and obesity for South African children make it difficult for comparison with global figures.

Many chronic and potentially fatal conditions are associated with obesity. Hypertension

and type-2-diabetes are but two of the secondary conditions associated with overweight and obesity. Current literature has shown evidence of a global increase in the incidence of essential hypertension and type-2-diabetes in the paediatric population (especially amongst adolescents)

CONCLUSION

It is concluded that overweight and obesity are on the increase amongst children and adolescents, and that various risk factors appear to be associated with the increase in incidence of these worldwide phenomena in particularly the developing sections of societies. It is important to note that diabetes and hypertension as examples of secondary outcomes are associated with overweight and obesity at a much younger age.

CHAPTER 3

THE DATA, THEIR TREATMENT AND THEIR INTERPRETATION

3.1 INTRODUCTION

Chapter three attempts to provide a detailed outline of the data collection techniques and quality control measures employed to obtain meaningful data pertaining to this study. The validity and reliability of data are widely recognized as one of the most important factors within any scientific study. In order to ensure valid and reliable data, a multistage sampling strategy was adopted and a pilot study was performed in children of similar characteristics as the target population. An overview of the pilot as well as the sampling strategy employed in the study is also outlined in this section.

3.2 THE DATA

Two types of data was used in this study:

- ❖ Primary data
- ❖ Secondary data

The nature of each of the two types of data will be discussed briefly.

3.2.1 Primary data

This study made use of primary data, which was obtained first hand during the data collection phase and, the data analysis when the data was analyzed for trends. The data

collection instruments used were: (a) questionnaires (b) Glucometers (c) Blood pressure monitor, and (d) the bioelectrical impedance monitor.

The researcher and adequately trained research assistants administered structured questionnaires to all participants. The questionnaires comprised of appropriate indicators of physical activity, obesity, hypertension and diabetes, as well as family history of the obesity, hypertension and diabetes. A questionnaire and checklist detailing the food habits and frequency of food consumption, was also administered to all participants. Other sources of primary data were data collected during the fingerpick test, the blood pressure measurement, height and weight measurement, anthropometric measurements and the urinalysis.

3.2.2 Secondary data

Secondary data refers to data that has already collected by other researchers or state vital records. This type of data is therefore already available. Secondary data were derived from textbooks, abstracts and journal articles related to the study under investigation. Additional information was also obtained from articles and/or abstracts on the Internet, as well as from personal interactions with professionals within the various areas of investigation (biokinetics and dietetics).

3.3 CRITERIA GOVERNING ADMISSIBILITY OF DATA

All measurements performed in the study were only regarded as valid if performed by well-trained individuals. Field workers thus went through intensive training prior to any data collection. To perform all clinical (blood) tests required for the study, the researcher

was given intensive training for one week under the supervision of a qualified Medical Technologist at the Peninsula Technikon, to refresh all knowledge of the test kits used. Qualified nurses at the resident campus clinic instructed the researcher on the use of the semi-automatic blood pressure monitor. The questionnaires used in this investigation were structured and based on existing standardised and validated questionnaires. All structured questionnaires were standardised and re-validated on school children. Standard protocols for the sampling of specimens were provided to all participants as well as the fieldworkers. All observers used standard prescribed anthropometric techniques.

3.4 THE RESEARCH METHODOLOGY

3.4.1 THE RESEARCH DESIGN

A repeated measures cross-sectional analytical study design was used for this investigation, where the dependent and independent variables were measured simultaneously. In a cross-sectional analytical study, a sample of the study population is investigated and information is collected on risk factors (exposures) and disease (outcome) at a specific point in time. The descriptive component of the study enables researchers to calculate the prevalence of the risk factors, as well as the prevalence of the disease. The analytical part of the study consists of comparing exposure groups with respect to the presence of disease (in the case of this study, overweight, obesity, diabetes and hypertension). The advantages of using this type of study include the fact that it is relatively inexpensive and easy to conduct.

3.4.2 STUDY POPULATION

The study population was recruited from the public or government funded mainstream primary and secondary schools located in the communities of Belhar, Delft and Mfuleni of Cape Town. The study population consisted of learners aged 10 - 16 years attending the public primary and secondary schools and residing in the communities of Belhar, Delft and Mfuleni. The Belhar and Mfuleni areas consist of a predominantly Coloured (individuals of mixed ancestry) and Indigenous African population respectively, while Delft has a heterogeneous population of both Coloured and African individuals. Most of the households in these communities are in the high middle- to lower income bracket, although unemployment is generally rife particularly amongst the young school leavers. The structure of the educational system provides an almost ready-made sampling frame (age, gender, educational level, geographical area, etc.).¹⁰⁸ In the light of this, it was appropriate to use schools instead of going directly to the families in these areas.

3.4.3 ETHICS

The Research Ethics Committee of the Peninsula Technikon approved the study. Written informed consent from parents as well as oral consent from learners was sought prior to any data collection by the fieldworkers. Permission was also obtained from the Western Cape Education Department, school governing bodies and principals at all schools included in the sampling frame.

3.4.4 RECRUITMENT AND PUBLICITY

Meetings were arranged with school principals, teachers and where possible, with the

learners in which the importance, benefits and advantages of the early detection of overweight, obesity and the obesity-related problems were emphasised.

3.4.5 SAMPLING

Based on the calculated power (80%), a proportionally representative sample of 421 learners was required for the study. To provide for exclusions and learners who might wish to discontinue participation, a sample size of eight hundred (800) would be used for the study. The sample population was obtained through Proportionally Stratified Multi-staged random sampling. The sampling strategy was formulated as follows:

Stage one of the sampling strategy involved calculating the proportional contribution of the primary and secondary learners to the composition of the study population (18722). These calculations showed that the study population consisted of sixty (60) percent primary school learners (grade 4 to 7) and forty (40) percent secondary (grade 8 to 10) school learners *Annex 2*). Secondly, the proportional contribution of the primary and secondary learner to the sample was established. Since the expected sample size was 800, 480 (60%) should be primary learners, and 320 (40%) should be secondary learners.

The fourth step was to calculate the proportion of the primary and secondary learners respectively in the respective communities. This was calculated as: Belhar primary schools = 186, Delft primary schools (290) and Mfuleni primary schools (33); while the secondary schools were: Belhar (160), Delft (180), and Mfuleni (1). The next step was to calculate the proportional contribution of each school in each of the respective areas. The amount of students required from each school and ultimately from each class could

then be determined. Random selection took place at both the class level and the learner level. A random selection table was used for the selection. According to Bless and Higson-Smith¹⁰⁹, the principle of stratification is to divide the population into different groups, called strata, so that each element of the population belongs to one and only one stratum. In this case the population was stratified in terms of area or location (Belhar, Delft and Mfuleni), and gender.

Schools that refused to participate were approached twice or thrice either personally or telephonically if possible. Seventeen of the twenty-seven schools in the locations participated in the survey. Due to time constraints and other logistical problems, a final proportionally representative sample of four hundred and one (401) learners (randomly selected children and adolescents attending primary and secondary schools) was obtained and included in the study. Participation rates for schools and learners were thus 62.96% and 50.13% respectively.

3.4.6 VALIDITY AND RELIABILITY OF RESULTS

3.4.6.1 Questionnaire Design

All the questionnaires employed in the study were designed based on existing validated questionnaires. The Food Frequency questionnaire (checklist) was developed based on a standardised questionnaire by Christakis *et al.*¹¹⁰ The most frequent food items named in the questionnaires were selected to comprise the final questionnaire. Foods were selected according to the food groups in the food pyramid (vegetables, meat and meat derivatives, milk and its derivatives). Soft drinks, alcoholic beverages, high-fat-containing

snacks and sweets were also included in the food checklist.

The Physical Activity & Energy expenditure questionnaire was developed based on the validated questionnaire designed by Arvidsson et al.¹¹¹ The questionnaire was designed to contain indicators of sporting as well as leisure activities and assessed the frequency and type of activities learners participated in.

The Family Health-related History and Behaviour questionnaire was developed based on the questionnaire by the National Wellness Institute used in the US National Youth Risk Behaviour Survey of 1999, as well as their Health Risk Appraisal questionnaire.¹¹² This questionnaire was designed to provide information on the familial risk factors of participants, their lifestyle (general dietary and physical activity patterns) and habits such as smoking and consumption of alcoholic beverages.

3.4.6.2 Validation of Questionnaires

All questionnaires were piloted in order to identify all possible areas that could be refined or changed. The pilot study assessed aspects such as the perception and interpretation of questions, the appropriate language to be used, the length of the questionnaires and the effectiveness of the questions used in the questionnaires. The Food Consumption Frequency Checklist and Physical Activity and Energy Expenditure questionnaires used in this study were pre-tested and validated amongst twenty-two (22) randomly selected learners from the study population. The area selected for the pilot study was similar in composition, and the subjects chosen for this pre-test were also similar in characteristics to the study population. One week after the initial administration of the questionnaires, repeated measures were taken of a sub-group (50%) of the sample population. This was

done in order to strengthen and to increase the validity and reliability of the questions in the Family health-related history questionnaire, the Food Consumption Frequency Checklist and Physical Activity and Energy Expenditure questionnaires.

3.4.6.3 Quality Control

In this study certain questionnaire design strategies were used to ensure quality control. In order to validate the results and as a means of quality control, multiple crosscheck questions on the same topic were included in the questionnaires. All questionnaires were administered and completed in the presence of a thoroughly trained fieldworker. This strategy provided the field workers the opportunity to clarify all queries, without influencing (bias) the outcomes. Their physical presence also allowed questionnaires to be checked for proper completion. Consistency, precision and reliability of measurement were further enhanced by means of the employment of the thoroughly trained observers used during the data-collection.

Observers were trained in the use of the prescribed standardised techniques. These standardised techniques and associated data-collection instruments were also piloted. Careful selection of instruments with adequate detection limits and sensitivity was done to enhance the accuracy and validity of results. Statistical measures in the form of repeated measures were used to ensure inter- and intra-validity. Standard protocols for the collection of specimens were provided to all participants, as well as protocols for standardised measurement techniques were provided to all observers. Clearly defined cut-off points were used for the classification of overweight, obesity, diabetes and hypertension as per delimitations.

In order to enhance the quality of the study, proper calibration of all direct reading instruments was done on a regular basis, as per manufacturers' instructions. All digital scales used in this study were calibrated before and after each set of ten measurements. In the case of the weight of the participants, initial calibration was done with the aid of a standard metal weight on a thread; thereafter the weight of the fieldworkers doing the measurement at the sample site was used to do the daily calibration. To avoid erroneous readings, the Glucometers (Accutrend) were checked after every ten measurements to ensure that all four digits and the decimal point are legible on the display. Accuracy of the glucometer measurements were checked by means of visual comparisons with the colour scale printed on the label of the test strip container, as well as the use of reference or control reagents. To ensure reliability, all laboratory equipment was calibrated against standard control material. The principal investigator performed all clinical analyses or measurements. Sample size calculations were statistically determined with the aid of a reputable statistical package, in order to ensure acceptable precision and to enhance the validity of the results obtained by means of statistical inferences.

3.5 THE PILOT STUDY

3.5.1 Introduction

The pilot study was conducted two months prior to the start of the main data collection phase, following the fieldworker training sessions. The pilot study was conducted among 20 learners randomly selected from a school in the community similar to the study population. The aim of the pilot study was to test the administration of the questionnaires

by the fieldworkers and evaluate the dietary (Food Consumption Frequency)¹¹⁰, the physical activity¹¹¹ and the general (Family Health-related History)¹¹² questionnaires, with respect to the ability of the respondents to comprehend and respond to the questions, the effectiveness of the questions used in the questionnaires and the time required for the completion of an interview, in order to identify all possible areas that could be refined or changed. All the logistics of the fieldwork, such as the transportation of fieldworkers and equipment, and the collection of the samples were also tested.

3.5.2 Study Population

The study population of the pilot study consisted of children and adolescent (young adults) similar in characteristics to the study population in the actual study to be conducted later. Of the thirty-one learners originally selected, only sixteen learners participated. Six other learners were randomly selected to make up the final twenty-two (22) learners that eventually participated. The final sample consisted of 50% (11) boys and 50% (11) girls, with a participation rate of 71% (70.97%).

3.5.3 Preparation For Pilot

Class lists were obtained of all classes in the grades four to eight. Classes were selected through the toss of a coin, while learners were randomly selected using the statistical package Intercooled STATA version 7. A meeting was arranged with the selected learners where all aspects regarding the study were explained and all consent forms (*Annex 3*) handed to the prospective participants. To ensure informed consent, all ethical issues were discussed and learners were given the opportunity to ask questions if necessary. Informed written consent was obtained from the children, their parents as

well as the principal.

The principle researcher and fieldworkers attended an intensive two-day workshops before the fieldwork commenced, in order to standardize interview techniques and the collection of measurements. In addition to the practical training sessions in the execution of anthropometric measurements at the Sports Science Institute of South Africa, Newlands, the fieldworkers received a reference-training manual, which documented the research methods. The training of the fieldworkers was conducted by Hitesh Harribhai, a post-graduate biokinetics student from the Bioenergetics of Exercise Research Unit at the University of Cape Town, Sports Science Institute of South Africa. To finalize the equipment and logistics for the pilot, a practice run using two models was successfully conducted.

To further ensure validity and reliability of the questions, questionnaires were translated into Afrikaans, which was the predominant home language of the majority of the learners in the pilot study population.

3.5.4 The Pilot

3.5.4.1 Methodology

The fasting urinalyses, all blood tests, height and weight measurements, the first blood pressure measurement(s) and the administration of the Family Health-Related History Questionnaire (*Annex 4*)¹¹² were all done before 10h00 in the morning. Learners were then given refreshments and twenty minutes to finish and relax. This was done to allow adequate time for learners' blood pressure to return to normal. The second blood pressure measurement(s) were then taken, followed by the skin folds measurements,

and the third blood pressure measurement, the Physical Activity (*Annex 5*)¹¹¹ and the Food Consumption Frequency Checklist. (*Annex 6*)¹¹⁰

Each subject was weighed, wearing only light clothing and without shoes. The height was measured using a stature meter, which was secured against a flat wall to ensure correct reading. Each subject was requested to stand barefoot on the floor, with the back and legs straight, heels against the wall and the back of the head placed against the wall. The head was positioned in such a way that the angle of the eye and the opening of the external auditory meatus were on a horizontal line (Frankfurt plane). The height was then measured to the nearest 0.01 cm.

The body composition of the subjects was assessed by anthropometric measurements. Skin fold measurements were taken using a Holtain[®] skin fold caliper with a constant jaw pressure of 10 g/mm² and were taken to the nearest 2 mm. Percentage body fat was calculated according to the Durnin-Womersley equation. The most recent growth curves, as generated by the Centers for Disease Control and Prevention (CDC) National Center for Health Statistics (NCHS), were used to define overweight and obesity.

All measurement information was entered onto a structured data collection sheet. (*Annex 7*) Completed questionnaires were checked for inconsistencies and errors by the fieldworker supervisors, who closely monitored the data collection.

3.5.4.2 Parental Interviews

These subjects were conveniently selected based on parents that were home during the day. Ten parents were selected for these interviews. Due to unavailability of the parents,

only five parents were interviewed; four of the originally selected parents and one replacement. Parents were interviewed at home and all the anthropometric measurements and blood tests were also administered to these parents.

3.5.4.3 The Repeat Measures

A repeated measures sampling was done one week after the initial data collection. To minimize observer bias, the same person who had interviewed each of the participants in the baseline survey administered the questionnaires. All fieldworkers were retrained to conduct the Food Consumption Frequency questionnaire and physical activity questionnaire prior to the validation study.

From the eleven (11) conveniently selected subjects, only six arrived. Four replacements were obtained to make up the final ten subjects. The repeat sample was thus 45.5% of the study population.

3.5.5 Conclusion

The pilot study provided the opportunity to identify specific problems with the data collection instruments. The identification of the major logistical aspects relating to the implementation of the data collection tools was determined. The approximate time spent per questionnaire and the taking of all appropriate measurements per research subject were identified as a major attribute determining the total number of participants to be scheduled per day. The pilot study also revealed that an independent and adequately trained person other than the researcher was required to monitor the fieldworkers in order to ensure proper and accurate data collection.

3.6 THE SPECIFIC TREATMENT OF EACH SUB-PROBLEM

3.6.1 Sub-problem one

3.6.1.1 The Sub-problem Statement

To determine the prevalence of childhood obesity amongst learners attending school aged 10 - 16 years and residing in the communities of Belhar, Delft and Mfuleni in the city of Cape Town.

3.6.1.2 The data needed

The data needed for testing the hypothesis of sub-problem one were obtained from the results of the Anthropometric measurements and body composition analysis.

3.6.1.3 Location of the data

The data were collected from the children and adolescents aged 10 - 16 years at the selected schools in the Belhar, Delft and Mfuleni communities.

3.6.1.4 Means of obtaining the data

Data were collected by means of anthropometric measurements and body composition analysis.

3.6.1.4.1 Height Measurements

Height was recorded to one decimal place using a measuring tape (stature meter). Just before the measurement of height, the subjects were advised to keep their heels together, feet flat on the ground and to inhale deeply, hold the breath, and maintain an

erect position (posture). The head was positioned in such a manner that the angle of the eye and the opening of the external auditory meatus were in a horizontal line. Height measurements were read to the nearest 0.1 cm and with the eye level with the measuring apparatus to avoid errors due to parallax.

3.6.1.4.2 Weight Measurements

Measurements were taken with each subject in light clothing and without shoes and socks. Weight was determined on a good-quality digital bathroom scale, which was initially calibrated and standardised using a weight of known mass. Thereafter, the researchers or fieldworkers' own weight, measured daily, was used as reference before weighing each subject. The scale was then calibrated with the metal weights at the end of the day's data collection. Weight was recorded in kilograms up to one decimal place.

3.6.1.4.3 Waist-hip Circumference Ratio

To perform the waist measurement, the lowest rib margin was first located and marked with a felt tip pen. The iliac crest was then palpated in the mid-axillary line and also marked. Subjects were asked to breathe normally, and to breathe out gently at the time of the measurement to prevent them from contracting their muscles or from holding their breath.⁶⁰ Using a fiberglass measuring tape, held firmly to stay in position around the abdomen about the level of the umbilicus, measurements were taken to the nearest millimeter.

For the hip circumference measurement, the subject was asked to stand erect with arms at the side and feet together. The waist-hip circumference ratio was then calculated by dividing the waist circumference measurement by the hip circumference measurement.

Both measurements were recorded to the nearest millimeter.

3.6.1.4.5 Body Mass Index

In order to classify participants into the different nutritional status groups, Body Mass Index (BMI) was calculated for each subject as weight (kg) / height² (m). BMI was analyzed using the international reference provided by the International Obesity Task Force (IOTF).^{19,56} Due to the endorsement given to the use of this index for children by the international scientific community, the percentiles usually employed for the paediatric population were not used. Instead, the cut-off points for obesity were BMI ≥ 30 for all subjects, for overweight at BMI > 25 and ≤ 29.9 and normal weight at ≥ 19 .¹¹³

3.6.1.4.6 Body Composition Analysis

Total body fat as well as its percentage was determined using body composition analysis. As bioelectrical impedance measurements are influenced by the hydration status of the body, each subject were given two glasses of water to drink and asked to remain seated until the time of measurement. Following the height and weight measurements, subjects were asked to remove their right shoe and sock and to lie down with the arms and legs spread slightly in the supine position. As far as possible, care was taken to avoid the inner thighs from touching. The self-adhesive disposable electrodes were attached to the right hand and foot, to avoid the battery current passing through the side of the body where the heart is situated. Electrodes were placed behind the second toe next to the big toe and on the ankle at the level of and between the medial and lateral malleoli (the large protruding bones on the sides of the ankle. A time delay of 4 to 5 minutes, with the subject lying in the supine position, was allowed to

ensure that the fluid levels has stabilized in the body. Subject data (age, height, weight, gender) was entered into the handheld unit, the electrodes connected, and the measurements (percentage body fat, body fat in kilograms, percentage lean body mass, lean body mass in kilograms, total body mass, body mass index and the impedance measurement) were recorded onto the data collection sheet.

The regression equation or formula for body composition analysis used in the Bodystat[®] program is suited for the age group eighteen to seventy years. Data collected was downloaded from the unit into the body manager program and the Geriatric or Children's equation provided in the program was used to determine the body composition for the age groups of interest.

3.6.1.5 Treatment of data

All measurement data collected was recorded on a data-capturing sheet, which was used to generate a STATA intercooled version 7¹¹⁴ data file. This data was then used to describe the prevalence of overweight and obesity amongst the children in the sample population.

Figure 3.1: Bioelectrical Impedance Analysis



3.6.2 Sub-problem Two

3.6.2.1 The Sub-problem Statement

To determine whether a family history of obesity, diabetes and/or hypertension predisposes the learners attending these schools to become diabetic and/or hypertensive or obese.

3.6.2.2 The data needed

The data needed for testing the hypothesis of sub-problem two was obtained from the results of the blood pressure measurements, finger prick test, the urinalysis and the structured family health-related questionnaire.

3.6.2.3 Location of the data

The data was collected from the children and adolescents aged 10 - 16 years in the

Belhar, Delft and Mfuleni communities in the city of Cape Town.

3.6.2.4 Means of obtaining the data

A structured questionnaire - the Family Health-related History and Behaviour Questionnaire¹¹² (*Annex 4*) - designed to obtain information on the family health history (immediate as well as extended family), socio-economic profile (parental education, occupation and income, type of accommodation) and life-style behaviour of subjects was administered to all participants. The information obtained from this questionnaire was employed in the statistical analysis.

3.6.2.4.1 Blood Pressure Measurements

In order to measure blood pressure, subjects were seated in a chair with their backs supported, and their arms bared and supported at heart level on a table. Measurement was performed using a semi-automatic digital blood pressure monitor on the right arm, with the learner not having ingested coffee or smoked for 30 minutes before measurement and after at least five minutes of rest. The cuff was placed at a point midway between the olecranon and acromion to ensure an accurate measurement. Measurements were performed three times at an interval of at least ten minutes, and an average was obtained for each subject.

Blood pressure for children was classified as normal when both the systolic- and diastolic blood pressure was less than the 90th percentile for age, gender, and height. A high-normal blood pressure was diagnosed when the systolic- or the diastolic blood pressure is between the 90th and 95th percentile. Based on the guidelines by the International Obesity Task Force (IOTF) and The World Health Organization (WHO)¹¹⁵, a

child or adolescent is classified as hypertensive if the individual presents with both systolic and diastolic blood pressure levels above the 95th percentile on three separate occasions. The cross-sectional design of this study limits measurement of one point in time. Blood pressure measurements of subjects could thus also just be measured once. In the light of this, it was considered appropriate to rather look at elevated high blood pressure as opposed to hypertension.

Participants were classified as having elevated (high) blood pressure if they have a systolic- or diastolic blood pressure above the 95th percentile.¹¹⁵ Participants were also classified as having elevated blood pressure if they reported taking anti-hypertensive medication either currently or in the past. Three primary school learners indicated that they took medicine for high blood pressure, but upon being questioned about it at a later stage, they responded negatively to the question. It was thus decided to record the response as negative.

3.6.3.4.2 The Finger Prick Test

This was done with the Accutrend GCT meters to obtain information on the subject's blood glucose, triglyceride and cholesterol levels. According to the supplier, the Accutrend has a mean imprecision of <5%, while the coefficient of variance was 3.7%. The detection limit has been shown for the range 1.1 - 33.3 mmol/L.

Participants were asked to fast for a period of at least 10 hours prior to sampling. On the day of sampling, the participant's fingertip was first cleansed with sterile webcol alcohol swabs. The side of the finger was then pricked with a lancet (using a readily available,

semi-automated lancet device), as this part is less sensitive than the tip. Sufficient time was given for a drop of blood to form. An individual with a fasting blood glucose value between 6.2 - 6.94 was classified as being glucose intolerant, while a value equal to or greater than 7.0 mmol/l was diagnostic of diabetes. Hyperlipidaemia was defined as total cholesterol of ≥ 6.24 mmol/L and/or triglyceride ≥ 3.9 mmol/L, or treatment for hyperlipidaemia. Plasma triglyceride concentrations increase after a fatty meal and remain elevated for several hours. For quality control measures, the triglyceride value was thus used to check whether the subject had fasted or not.

Figure 3.2: The Accutrend Fingerprick Test



3.6.3.4.3 The Urinalysis

All research participants were provided with a typed protocol outlining the correct procedures for the collection of urine specimens. (*Annex 8*) This protocol was also read out loud and explained by observers before urine sampling. Urine specimens were collected and stored in sturdy screw-capped plastic containers. Urinalysis was

performed on site using a commercial dipstix test kit and results recorded as negative or positive.

3.6.3.4.4 Measurement of Venous Blood Glucose Concentration

A repeat fasting blood glucose test was done only on subjects with elevated glucose and cholesterol values in both the initial and repeated Glucometer test and the urinalysis. Subjects were asked to fast for a period of 10 hours prior to sampling.

3.6.3.5 Treatment of data

All measurement data collected was recorded on a data-capturing sheet, which was used to generate a STATA Intercooled version 7¹¹⁴ data file. Categorical variables were created for systolic pressure and diastolic pressure. This was used to create a variable to classify subjects as having normal, elevated /high normal or high blood pressure based on the 90th and 95th percentile as recommended by the World Health Organization (WHO).

A subject was classified as diabetic if the individual had a fasting blood glucose reading above 7.0 mmol/l, and a positive urinary glucose result. The available data was then analyzed to establish if any of the participants were suffering from diabetes, hypertension or whether they can be classified as overweight or obese.

3.6.3 Sub-problem Three

3.6.3.1 The Sub-problem Statement

To determine the risk factors associated with obesity amongst children aged 10 - 16

years in the Belhar, Delft and Mfuleni communities in the city of Cape Town.

3.6.3.2 The data needed

The data needed for testing hypothesis three was derived from the information obtained from the structured questionnaire.

3.6.3.3 Location of the data

The data was collected from the children and adolescents aged 10 - 16 years in the Belhar, Delft and Mfuleni communities in the city of Cape Town.

3.6.3.4 Means of obtaining the data

Bless and Higson-Smith¹⁰⁹ states that the most structured way of getting information directly from the respondents is by means of a scheduled structured interview. This method is based on an established questionnaire. The questionnaire utilized in this study was structured to contain indicators to ascertain biographical data, lifestyle behaviours on topics including cigarette smoking and alcohol consumption, and medical and family history of cardiovascular diseases and hypertension, overweight, obesity, and diabetes.

Figure 3.3: Blood Pressure Measurement Using the Semi-automatic Blood Pressure Monitor



Three structured questionnaires, modified for the local conditions, were administered on each participant. The first questionnaire was a qualitative food consumption frequency checklist. The food consumption frequency checklist was developed based on a previously validated questionnaire designed by Christakis *et al*¹¹⁰, and was modified to contain indicators of dietary intake. The second questionnaire contained questions on physical activity and energy expenditure. Thirdly, the information obtained from the family health-related history and behaviour questionnaire, based on the questionnaire by the National Wellness Institute¹¹², was evaluated. In order to validate the results multiple crosschecked questions on the same topic were addressed to the participants.

3.6.3.5 Treatment of data

All measurement data collected were recorded on a data-capturing sheet in the statistical package STATA Intercooled version 7.¹¹⁴ This data was then analyzed to

identify the various risk factors associated with the prevalence of overweight, obesity, diabetes and hypertension in the children in the Belhar, Delft and Mfuleni communities. Simple and multiple logistic Regression and survey logistic regression analysis were also done to establish the significance of each of the risk factors identified.

3.7 DATA ANALYSES

In the interest of validity and reliability of the results generated by this study, the researcher personally encoded all completed questionnaires. An independent person, in the interest of reducing possible errors during codification and data capturing, performed a random quality control check. All data was captured in a data file and an appropriate identifiable name was given to each variable, including those generated, in the dataset. Analyses were done using the statistical package STATA intercooled version 7.¹¹⁴ Data was extensively cleaned using the various statistical options available in the STATA intercooled version 7¹¹⁴ statistical package. Following data cleaning, new categorical dummy variables were created in order to facilitate the calculation of associated risks. The outcome variables were dichotomized, as this would be useful in the characterization of the overall risks for the various outcomes.⁹⁶ The variables generated were:

Overweight - This was defined as a Body Mass Index (BMI) value equal to and greater than 25 and equal to and less than 29.9.^{19,22} Waist circumferences were also employed as a criterion in the assessment of overweight. Males were classified as overweight if waist circumference was greater than 94 cm, and girls were overweight if waist circumference was greater than 80 cm.⁴⁷ Though the use of waist circumference is not

recommended in the paediatric population, this was assessed for the purpose of this study. As overweight does not necessarily constitute an excessive accumulation of fat¹⁸, no category for overweight based on percentage body fat was developed.

Obese - This was defined as a Body Mass Index (BMI) value equal to and greater than 30.^{19,22} Obesity was also assessed through waist circumference and percentage body fat. Males were classified as obese if their waist circumference exceeded 120 cm. Girls were obese if waist circumference was greater than 88cm.⁴⁷

Hypertension - This variable was defined as a systolic and diastolic blood pressure above the 95th percentile, as per standards suggested by the International Obesity Task Force.⁶⁷

Physical Inactivity - For the purpose of this study, subjects were classified as physically inactive if the individual did not participate in sports, had no household chores, exercised once or less per week and watched television for more than 4 hours per day.

Poor Diet - Based on the limitations of the available data (as outlined in the limitations of this study) subjects were classified as having poor dietary habits if they ate away from home (take-a-ways) more than thrice per week.

Age Categories - For comparative purposes the learners were compared with each other based on age, learners were divided into four age groups. The four age group categories were determined based on the quartile distribution of the age distribution of the participants in the study.

Socio-economic Conditions - For the purpose of this study socio-economic conditions

of learners were evaluated based on the type of dwelling and household index. Learners were not classified into socio-economic class per se; instead the factors employed to classify socio-economic status (type of dwelling, household index, type of ablution facilities, etc.) were evaluated separately.

Once all the required variables were generated, exploratory and descriptive statistics were performed on the data. Summary statistics were calculated, including the measures of central tendencies and spread for all numeric variables. Frequencies were calculated for all categorical variables of interest. Pearson Chi-square statistics and Fisher's Exact statistics were computed to determine the associations between respective categorical outcome and predictor variables.

Simple Logistic Regression technique were employed in order to determine the individual variables that predicted categorical outcomes of this study, which was followed by multiple logistic regression analyses. A variety of variable selection procedures were adopted including stepwise variable selection methodology. To further strengthen the outcome of the results in the study, advanced statistical modeling, i.e. survey estimation: multiple logistic regression was employed on the data. This statistical analysis (survey estimation) yields more accurate estimates, as it takes into account the multi-stage sampling and stratification employed in the design of the study.

Associations of interest were the association between the independent variables (age, race, gender, physical activity, area of location, body mass index, waist circumference, percentage fat distribution, glucose levels, and cholesterol levels) and the outcome variables (overweight, obesity, hypertension and diabetes).

The primary outcome variables of interest were:

- ❖ Overweight
- ❖ Obesity

The secondary outcome variables of interest included:

- ❖ Elevated Blood glucose (diabetes)
- ❖ Elevated Blood Pressure (hypertension)

In the logistic regression models developed for overweight and obesity and elevated blood pressure, adjustments were made for potential confounding variable such as age, gender, and race. Amongst all of these potential confounding variables, statistical analysis proved age as the only potential confounding variable in all multiple regression models for which adjustments were made accordingly.

All the statistical tests were performed at a 5% level of significance. Thus, an alpha of 0.05 ($\alpha = 0.05$) was used as the criteria for determining significance of relationships between variables. The assumptions (normality, equality of variance and independence) underlying each of the statistical tests were evaluated and the appropriate statistical analysis was performed.

CHAPTER 4

RESULTS

4.1 INTRODUCTION

In this section, the main features and trends in the data are presented. These are exhibited in the form of graphical displays and a series of specific summary statistics performed on the data. The results are presented in three different categories i.e., univariate, bivariate and multivariate analysis in the form of simple logistic regression and survey multiple logistic regression analyses.

With this attempt an effort is made to provide the prevalence of the various outcomes of interest, such as overweight, obesity and elevated blood pressure and glucose levels of the subjects in the study. Specific observed associations between the outcome variable of interest and specific risk factors were explored as potential evidence to support or disprove formulated hypotheses and these are demonstrated in this chapter.

4.2 Demographic Characteristics

The demographic characteristics of the population with reference to age-female and race distributions, and socio-economic status are discussed.

4.2.1 Sample Population

Data was collected from 401 research subjects at the respective schools using three structured questionnaires. Sixty-three (63) subjects did not meet the inclusion criteria i.e., were not residing in Belhar, Delft and Mfuleni and/or were not aged 10-16, and were

thus excluded from the data analysis. Of the remaining total of 338 subjects, 195 (57.69%) of the sample were female and 143 (42.31%) male. (Table 4.1b)

The ages of the subjects ranged from 10 to 16 years as outlined in the delimitations. The mean age of the learners was 12.65 years with a standard deviation of 1.85 years. Girls were older than the boys with a mean age of 12.77 years (± 1.85 years) in comparison to the mean age of males at 12.48 years (± 1.83 years). (Table 4.1a)

Table 4.1a Age Distribution Stratified by Gender

| Characteristic | Total Population (n=338) | | Boys (n=143) | | Girls (n=195) | |
|-----------------|-------------------------------|-------------|-------------------------------|-------------|-------------------------------|-------------|
| | Mean \pm Standard Deviation | | Mean \pm Standard Deviation | | Mean \pm Standard Deviation | |
| Age (In Months) | 152.09 | ± 22.14 | 150.26 | ± 21.76 | 153.44 | ± 22.38 |
| Age (In Years) | 12.65 | ± 1.85 | 12.48 | ± 1.83 | 12.77 | ± 1.85 |

The age and gender distributions of learners are shown in Table 4.1b and Table 4.1c.

Table 4.1b Gender Distribution Stratified by Age Groups (Years)

| Gender | Age Categories | | | | Marginal Total |
|--------------|---------------------|--------------------|---------------------|---------------------|---------------------|
| | (10-11 yrs) | (12-13 yrs) | (14-15 yrs) | (16 yrs) | |
| Male | 40 (44.44%) | 39 (47.56%) | 32(38.55%) | 32 (38.55%) | 143 (42.31%) |
| Female | 50 (55.56%) | 43 (52.44%) | 51(61.45%) | 51(61.45%) | 195 (57.69%) |
| Total | 90 (100.00%) | 82(100.00%) | 83 (100.00%) | 83 (100.00%) | 338 (100%) |

In Table 4.1b, the overall sample consisted mostly of girls (57.69%). The proportion of girls was in all age categories more than the boys.

Table 4.1c Age & Gender Distribution According to Age Groups

| Gender | Age Categories | | | | Total |
|-----------------------|--------------------|-------------------|--------------------|--------------------|-------------------|
| | (10-11 yrs) | (12-13 yrs) | (14-15 yrs) | (16 yrs) | |
| Male | 40 (27.97%) | 39 (27.27%) | 32(22.38%) | 32 (22.38%) | 143 (100%) |
| Female | 50 (25.64%) | 43 (22.05%) | 51(26.15%) | 51(26.15%) | 195 (100%) |
| Marginal Total | 90 (26.63%) | 82(24.26%) | 83 (24.56%) | 83 (24.56%) | 338 (100%) |

At 26.63%, learners within the age group 10-11 years of age constituted the largest

proportion of the sample population. Learners aged 14-15 years of age, as well as 16 year olds - at an equal proportion of 24.56% - were the second largest group (Table 4.1c). There were more girls in the 14-15 and 16-year-old groups (26.15%) whilst there were more boys in the 10-11 years age groups (27.97% and 27.27% respectively).

The demographic characteristics of the learners in this study with respect to race, area of location and grade are presented in Table 4.2. Individuals were classified into races based on reported self-classification by the participant.

Table 4.2 Demographic Characteristics of Learners attending schools in Belhar, Delft and Mfuleni, Stratified by Age, Gender and Grade

| Characteristic | 10 - 11 Years | | 12 - 13 Years | | 14 - 15 Years | | 16 Years | |
|--------------------------|---------------|-------------|---------------|-------------|---------------|-------------|-------------|-------------|
| | Male | Female | Male | Female | Male | Female | Male | Female |
| Total = 338(100%) | 40 (11.8%) | 50 (14.7%) | 39 (11.5%) | 43 (12.1%) | 32 (9.5%) | 51 (15.1%) | 32 (9.5%) | 51 (15.1%) |
| Race | | | | | | | | |
| Black (n=87) | 3 (7.50%) | 16 (32.0%) | 11 (28.21%) | 7 (16.28%) | 8 (25.0%) | 12 (23.53%) | 13 (40.63%) | 17 (33.33%) |
| Coloured (n=249) | 36 (90.0%) | 34 (68.0%) | 28 (71.79%) | 36 (83.72%) | 24 (75.0%) | 39 (76.47%) | 19 (59.38%) | 33 (64.71%) |
| Other (n=2) | 1 (2.50%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (1.96%) |
| Area of Location | | | | | | | | |
| Belhar (n=161) | 28(70.0%) | 28 (56.0%) | 19 (48.72%) | 20 (46.51%) | 15 (46.88%) | 20 (39.22%) | 13 (40.63%) | 18 (35.29%) |
| Delft (n=126) | 12 (30.0%) | 14 (28.0%) | 13 (33.33%) | 18 (41.86%) | 14 (43.75%) | 23 (45.10%) | 11 (34.38%) | 21 (41.18%) |
| Mfuleni (n=51) | 0 (0%) | 8 (16.0%) | 7 (17.95%) | 5 (11.63%) | 3 (9.38%) | 8 (15.69%) | 8 (25.0%) | 12 (23.53%) |
| Grade | | | | | | | | |
| Grade 4 (n=50) | 21(45.65%) | 25 (54.35%) | 3 (75.0%) | 1(25.0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Grade 5 (n=46) | 13 (42.86%) | 14 (51.85%) | 12 (75.0%) | 4 (25.0%) | 2(66.67%) | 1 (33.33%) | 0 (0%) | 0 (0%) |
| Grade 6 (n=73) | 6 (42.86%) | 8 (57.14%) | 18 (40.91%) | 26 (59.09%) | 8 (72.73%) | 3 (27.27%) | 3 (75.0%) | 1 (25.0%) |
| Grade 7 (n=49) | 0 (0%) | 1 (100%) | 6 (37.50%) | 10 (62.50%) | 11(37.93%) | 18 (62.07%) | 2 (66.67%) | 1 (33.33%) |
| Grade 8 (n=60) | 0 (0%) | 1 (100%) | 0 (0%) | 1 (100%) | 10 (33.33%) | 20 (66.67%) | 16 (57.14%) | 12 (42.86%) |
| Grade 9 (n=36) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 1 (10.0%) | 9 (90.0%) | 4 (16.0%) | 21 (84.0%) |
| Grade 10 (n=24) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) | 7 (30.43%) | 16 (69.57%) |

Eighty-seven (25.74%) of the learners were African (Black), and 249 (73.67%) were Coloured. Two of the subjects (0.59%) belonged to a different race group than those listed in the questionnaire. Sixty-one point eleven (61.11%) of Black learners were boys from the 12-13 years age group while 60% of Black girls were from the 10-11 years age group. Amongst the Coloured learners, 51.43% of the boys were from the 10-11 year

age group and 63.46% of girls were from the 16-year age group. Almost forty eight percent (47.63%) of the total subjects resided in Belhar, 37.28% in Delft, while 15.09% resided in the Mfuleni community. Learners were recruited from grade four up to and including grade ten. The greater parts of the learners were from the Grades 6 (21.60%) and Grade 8 (17.75%) respectively. A gender-specific outline of the distributions within the various grades is provided in Table 4.2.

4.2.2 Socio-economic Status of Participants

Indicators for socio-economic conditions employed in this study included: type of dwelling and household members. Socio-economic status as assessed by number per household is illustrated in Table 4.3a & Table 4.3b.

Table 4.3a Gender Distribution of Total Household Number and Sibling Numbers

| Indicator | Total Sample (n=338) | | Males (n=143) | | Girls (n=195) | |
|-----------------------------|----------------------|----------------------|---------------|----------------------|---------------|----------------------|
| | Mean | ± Standard Deviation | Mean | ± Standard Deviation | Mean | ± Standard Deviation |
| Total Inhabitants/household | 5.56 | ± 2.15 | 5.55 | ± 2.20 | 5.57 | ± 2.12 |
| Total Siblings/household | 2.70 | ± 1.73 | 2.61 | ± 1.75 | 2.76 | ± 1.73 |

Range for Total Number of Brothers and Sisters of Learners= 0 - 11

The number of children per household ranged from 0 to 11 (Table 4.3a). The majority of the research subjects in the overall sample had 2 brothers (mean=2.70, SD=1.73) and /or sisters. The results showed a mean household index of between 5 and 6 (mean=5.56, SD=2.15). Eighty-two (24.28%) of the subjects had seven or more people living in the same household (Table 4.3a). Results from the analyses of this study revealed that girls generally had more brothers and sisters than their male counterparts. Girls had slightly more household members than boys (5.57 ± 2.62)

Table 4.3b Total Household Numbers and Siblings According to Area of Location and Gender

| Indicator | Total Mean ± SD | Belhar | | Total Mean ± SD | Delft | | Total Mean ± SD | Mfuleni | |
|----------------|--------------------|-------------------|---------------------|--------------------|-------------------|---------------------|--------------------|-------------------|---------------------|
| | | Male Mean ± SD | Female Mean ± SD | | Male Mean ± SD | Female Mean ± SD | | Male Mean ± SD | Female Mean ± SD |
| | | Total Inhabitants | 5.80 ± 2.22 | | 5.89 ± 2.15 | 5.72 ± 2.28 | | 5.33 ± 1.92 | 5.46 ± 2.31 |
| Total Siblings | 2.61 ± 1.53 | 2.59 ± 1.57 | 2.63 ± 1.51 | 2.65 ± 1.87 | 2.46 ± 1.85 | 2.79 ± 1.88 | 3.08 ± 1.97 | 3.17 ± 2.12 | 3.03 ± 1.91 |

The socio-economic status of the learners as stratified by area of location and gender is illustrated in Table 4.3b. Boys had more family members per household than girls in the locations of Belhar and Delft. This trend was reversed in learners from Mfuleni where girls had more household numbers (5.94 ± 2.62). Furthermore, learners in Mfuleni had more brothers and sisters than learners in Belhar and Delft. This was mainly observed amongst the boys residing in Mfuleni.

Table 4.4 Socio-Economic Conditions of Learners Attending School in Belhar, Delft and Mfuleni (Type of Dwelling) (n=338)

| Dwelling | Total Freq (%) | Belhar | | | | Delft | | | | Mfuleni | | | |
|------------------|-------------------|--------------|------------------|--------------|------------------|---------------|------------------|---------------|------------------|---------------|-----------------|---------------|-----------------|
| | | Male | | Female | | Male | | Female | | Male | | Female | |
| | | Black n=2 | Coloured n=72 | Black n=0 | Coloured n=85 | Black n=16 | Coloured n=34 | Black n=19 | Coloured n=57 | Black n=17 | Coloured n=1 | Black n=33 | Coloured n=0 |
| House (n=302) | 89.35 | 100* | 90.28 | 0 | 96.47 | 93.75 | 91.18 | 94.75 | 98.25 | 58.82 | 100 | 60.61 | 0 |
| Flat (n=10) | 2.9 | 0 | 8.33 | 0 | 2.35 | 0 | 0 | 0 | 0 | 0 | 0 | 6.06 | 0 |
| Back Room (n=3) | 0.89 | 0 | 0 | 0 | 1.18 | 0 | 5.88 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hostels (n=6) | 1.78 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17.65 | 0 | 9.09 | 0 |
| Shack (n=15) | 4.44 | 0 | 1.39 | 0 | 0 | 6.25 | 0 | 5.26 | 0 | 23.53 | 0 | 24.24 | 0 |
| Wendyhouse (n=2) | 0.59 | 0 | 0 | 0 | 0 | 0 | 2.94 | 0 | 1.75 | 0 | 0 | 0 | 0 |

*Frequencies (learners residing in various types of dwellings)

Of the respondents participating in the study, fifteen (4.44%) of the participants lived in informal dwellings (shack), while 302 (89.35%) lived in formal houses of various sizes. Ten (2.96%) of the subjects lived in flats and 5 (1.48%) of the participants lived in a room in the backyard (Table 4.4). Living in shacks was more common amongst Black learners attending school in the community of Mfuleni (24.24% and 23.53% for girls and boys respectively), as well as amongst the Black learners in Delft (5.26% in girls and 6.25% in

males). On the other hand, residing in flats and backrooms were more common amongst the Coloured learners, specifically amongst Coloured girls residing in Delft (98.25%).

4.2.3 Family Health History, Lifestyle and Behaviour of Learners

Demographic data relating to the family health history, lifestyle and behaviour of participants are depicted in Tables 4.5a -Table 4.5c. Thirty-nine (11.54%) subjects in the sample reported a family history of diabetes amongst their first-degree relatives (Table 4.5a). Nineteen (13.38%) were males and 20 (10.31%) were girls. From the 102 (30.18%) subjects who reported second-degree diabetes, 43 (29.58%) were males and 59 (30.41%) were girls. A family history of diabetes was more common amongst the Coloured learners compared to Blacks.

Table 4.5a Demographic Characteristics Stratified by Gender and Race (n=338)

| Characteristic | Obs | Male | | Obs | Female | |
|--|-------------|-------------|-------------|--------------|-------------|-------------|
| | | Black | Coloured | | Black | Coloured |
| Family History of Diabetes | | | | | | |
| <i>First Degree Relatives (M=142, F=194)*</i> | 19 (13.38%) | 3 (8.57%) | 16 (14.95%) | 20 (10.31%) | 2 (3.85%) | 18 (12.68%) |
| <i>Second Degree Relatives (M=142, F=194)</i> | 42 (29.58%) | 11 (31.43%) | 31 (28.97%) | 59 (30.41%) | 12 (23.08%) | 47 (33.10%) |
| Heart Problems (M= 142, F=194) | 12 (8.45%) | 1 (2.86%) | 11 (10.28%) | 3 (1.55%) | 0 (0.00%) | 3 (2.11%) |
| Family History of High BP (M= 142, F=194) | 24 (16.90%) | 7 (20.00%) | 17 (15.89%) | 35 (18.04%) | 8 (15.38%) | 27 (19.01%) |
| Smoking (M= 142, F=194) | 11 (7.75%) | 1 (2.86%) | 10 (9.35%) | 14 (6.70%) | 0 (0.00%) | 13 (9.15%) |
| Alcohol Consumption (M= 142, F=194) | 7 (4.93%) | 0 (0%) | 7 (6.54%) | 5 (2.58%) | 0 (0%) | 5 (3.52%) |
| Physical Inactivity (M=139, F=189) | 55 (39.57%) | 14 (40.00%) | 41 (39.42%) | 115 (60.85%) | 24 (46.15%) | 91 (66.42%) |
| Participation in Sport (M=135, F=186) | 84 (62.22%) | 21 (60.00%) | 63 (63.00%) | 74 (39.78%) | 28 (53.85%) | 46 (34.33%) |
| Overweight (M= 142, F=194) | 4 (2.82%) | 0 (0.00%) | 4 (3.74%) | 24 (12.44%) | 12 (23.08%) | 12 (8.51%) |
| Obesity (M= 142, F=194) | 4 (2.82%) | 1 (2.86%) | 3 (2.80%) | 6 (3.11%) | 2 (3.85%) | 4 (2.84%) |
| Elevated Blood Pressure (M= 142, F=194) | 7 (4.93%) | 2 (5.71%) | 5 (4.67%) | 12 (6.19%) | 3 (5.77%) | 9 (6.34%) |
| Elevated Blood Glucose (M= 142, F= 194) | 1 (0.70%) | 0 (0.00%) | 1 (0.93%) | 1 (0.52%) | 0 (0.00%) | 1 (0.70%) |

* M= Male, F= Female

One percent (1.18%) of the subjects reported that they had lost one of their parents due to heart attacks, and one (0.30%) lost both. Heart problems were reported by 15 (4.73%) of learners in the study. Twelve (80%) were male and 3 (20%) were female.

Heart problems were more common amongst Coloured learners, with males having the highest frequency (10.28%). Only 1 (2.86%) of the Black males reported heart problems, while none of the Black girls experienced heart problems. A family history of high blood pressure was more common amongst Coloured males (20.00%) and girls (19.01%).

Smoking was reported by 25 (7.40%) of the learners with the sample population. Of the 25 smokers, 11 (44%) were male and 14 (56%) were female, with it being predominantly observed in both Coloured males and girls (9.35% and 9.15% respectively).

Alcohol intake was reported by 12 (3.55%) of the learners, with it being more frequent amongst males (4.93%). The consumption of alcoholic beverages solely occurred amongst Coloured learners in the sample.

172 (52.12%) of the learners were physically inactive (Table 4.5a), with a higher rate of physical inactivity amongst girls (60.85%). Fifty-five (39.57%) of the males and 115 (60.85%) of the girls in the study were found to be physically inactive, with it being more common amongst Coloured girls (66.42%)

Table 4.5b Demographic Characteristics by Age (Years), Gender and Race (n=338)

| Characteristic | Obs | Male | | Obs | Female | | |
|-----------------------------------|--------------|-------------|-------------|------------|-------------|-------------|-------------|
| | | Coloured | Black | | Coloured | Black | |
| Family History of Diabetes | | | | | | | |
| First Degree Relatives | 10 -11years | 7 (17.95%) | 6 (16.67%) | 1 (33.33) | 11 (22.00%) | 10 (29.41%) | 1 (6.25%) |
| | 12 -13 years | 2 (5.13%) | 2 (7.14%) | 0 (0.00%) | 4 (9.30) | 3 (8.33%) | 1 (14.29) |
| | 14 -15 years | 7 (21.88) | 7 (29.17%) | 0 (0.00%) | 5 (9.80%) | 5 (12.82%) | 0 (0.00%) |
| | 16 years | 3 (9.38%) | 1 (5.26%) | 2 (15.38%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) |
| Family History of Diabetes | | | | | | | |
| Second Degree Relatives | 10 -11years | 10 (25.64%) | 9 (25.00%) | 1 (33.33%) | 13 (26.00%) | 11 (32.35%) | 2 (12.50%) |
| | 12 -13 years | 11 (28.21%) | 7 (25.00%) | 4 (36.36%) | 17 (39.53%) | 15 (41.67%) | 2 (28.57%) |
| | 14 -15 years | 12 (37.50%) | 10 (41.67%) | 2 (25.00%) | 19 (37.25%) | 18 (46.15%) | 1 (8.33%) |
| | 16 years | 9 (28.13%) | 5 (26.32%) | 4 (30.77%) | 10 (20.00%) | 3 (9.09%) | 7 (41.18%) |
| Heart Problems | | | | | | | |
| | 10 -11years | 3 (7.69%) | 3 (8.33%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) |
| | 12 -13 years | 3 (7.69%) | 2 (7.14%) | 1 (9.09%) | 0 (0.00%) | 0 (0.00%) | 0(0.00%) |
| | 14 -15 years | 3 (9.38%) | 3 (12.50%) | 0 (0.00%) | 1 (1.96%) | 1 (2.56%) | 0 (0.00%) |
| | 16 years | 3 (9.38%) | 3 (15.79%) | 0 (0.00%) | 2 (4.00%) | 2 (6.06%) | 0 (0.00%) |
| Family History of High BP | | | | | | | |
| | 10 -11years | 5 (12.82%) | 5 (13.89%) | 0 (0.00%) | 7 (14.00%) | 4 (11.76%) | 3 (18.75%) |
| | 12 -13 years | 7 (17.95%) | 6 (21.43%) | 1 (9.09%) | 10 (23.26%) | 9 (25.00%) | 1 (14.29) |
| | 14 -15 years | 4 (12.50%) | 2 (8.33%) | 2 (25.00%) | 10 (19.61%) | 10 (25.64%) | 0 (0.00%) |
| | 16 years | 8 (25.00%) | 4 (21.05%) | 4 (30.77%) | 8 (16.00%) | 4 (12.12%) | 4 (23.53%) |
| Smoking | | | | | | | |
| | 10 -11years | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) |
| | 12 -13 years | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 1 (2.33%) | 1 (2.78%) | 0 (0.00%) |
| | 14 -15 years | 1 (3.13%) | 1 (4.17%) | 0 (0.00%) | 3 (5.88%) | 3 (7.69%) | 0 (0.00%) |
| | 16 years | 10 (31.25%) | 9 (47.37%) | 1 (7.69%) | 10 (19.61%) | 10 (30.30%) | 0 (0.00%) |
| Alcoholic Beverages | | | | | | | |
| | 10 -11years | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) |
| | 12 -13 years | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) |
| | 14 -15 years | 1 (3.13%) | 1 (4.17%) | 0 (0.00%) | 2 (3.92%) | 2 (5.13%) | 0 (0.00%) |
| | 16 years | 6 (18.75%) | 6 (31.58%) | 0 (0.00%) | 3 (6.00%) | 3 (9.09%) | 0 (0.00%) |
| Physical Inactivity | | | | | | | |
| | 10 -11years | 14 (36.84%) | 13 (37.14%) | 1 (33.33%) | 27 (56.25%) | 19 (59.38%) | 8 (50.00%) |
| | 12 -13 years | 16 (41.03%) | 13 (46.43%) | 3 (27.27%) | 27 (64.29%) | 24 (68.57%) | 3 (42.86%) |
| | 14 -15 years | 14 (46.67%) | 8 (36.36%) | 6 (75.00%) | 31 (63.27%) | 25 (67.57%) | 6 (50.00%) |
| | 16 years | 11 (34.38%) | 7 (36.84%) | 4 (30.77%) | 30 (60.00%) | 23 (69.70%) | 7 (41.18%) |
| Participation in Sport | | | | | | | |
| | 10 -11years | 24 (66.67%) | 22 (66.67%) | 2 (66.67%) | 21 (43.75%) | 13 (40.63%) | 8 (50.00%) |
| | 12 -13 years | 23 (60.53%) | 15 (55.56%) | 8 (72.73%) | 15 (38.46%) | 11 (34.38%) | 4 (57.14%) |
| | 14 -15 years | 16 (55.17%) | 14 (66.67%) | 2 (25.00%) | 18 (36.73%) | 12 (32.43%) | 6 (50.00%) |
| | 16 years | 21 (65.63%) | 12 (63.16%) | 9 (69.23%) | 20 (40.00%) | 10 (30.30%) | 10 (58.82%) |

Table 4.5b illustrates the demographic information amongst the specific age, gender and racial groups. The prevalence of first-degree diabetic relatives was more common amongst males aged 14-15 years and girls aged 10-11 years of age (21.88% and 22.00% respectively). Black girls particularly in the 10-11 year age group reported the highest frequency (29.41%). Coloured males in the 14-15 years of age group reported the highest incidence of first-degree diabetic relatives (29.17%), while second-degree diabetic relatives were more common in Black girls aged 12-13 years (39.53%) and Coloured males 14-15 years of age (37.50%). In general, a family history of diabetes,

were more frequently observed in Coloured learners.

Heart problems were more common amongst the males and girls in the 14-15 and 16-year age groups, with it being more frequent in 16-year-old Coloured males (15.79%).

Smoking occurred more frequently amongst males, with the highest frequency in 16-year-old Coloured males (47.37%). A similar trend was observed in Coloured girls in the 16 years age group. While smoking was reported by only one (7.69%) Black male, none of the Black girls reported that they smoked.

Alcohol intake was more common amongst Coloured learners with it being particularly common amongst males aged 16 years old (31.58%). Amongst girls, Coloured girls aged 14-15 years (5.13%) were more likely to consume alcohol. Neither the black males nor girls reported to be consuming alcohol.

Physical inactivity was more common amongst girls in all age groups in comparison to males. The highest prevalence of physical inactivity was observed in Coloured girls (69.70) in the 16 years age group, and in Black boys (75%) from the 14-15 year age group (Table 4.5b).

Participation in sport was more common amongst males in the 10-11 and 16-year age groups. The racial distributions revealed that Black boys in the 10-11 and 16 years age groups participated more frequently in sports (72.73% and 69.23% respectively). Sixteen-year- Coloured girls demonstrated a much higher prevalence of physical inactivity (66.42%) in comparison to Blacks. Girls aged 12-13 years and 16 years reported the highest prevalence of physical inactivity (68.57% and 69.70% respectively).

Table 4.5c Distributions of Demographic Characteristics of Learners Attending School in Belhar, Delft and Mfuleni, by Area of Location and Gender (n=338)

| Characteristic | Total | | | Belhar | | | Delft | | | Mfuleni | | |
|--|--------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------|-----|
| | Obs | Obs | Obs | Male | Female | Obs | Male | Female | Obs | Male | Female | |
| | | | | | | | | | | | | Obs |
| Family History of Diabetes <i>1st Degree Relatives</i> (M=142, F=194) <i>2nd Degree Relatives</i> (M=142, F=194) | 39 (11.54%) | 29 (18.01) | 12 (16.00%) | 17 (19.77) | 6 (4.76%) | 5 (10.00%) | 1 (1.32%) | 4 (7.84%) | 2 (11.11%) | 2 (6.06%) | | |
| | 102 (30.18%) | 54 (33.54%) | 23 (30.67%) | 31 (36.05%) | 34 (26.98%) | 19 (25.00%) | 15 (30.00%) | 14 (27.45%) | 5 (27.78%) | 9 (27.27%) | | |
| Heart Problems | 16 (4.73%) | 12 (7.45%) | 10 (13.33%) | 2 (2.33%) | 3 (2.38%) | 2 (4.00%) | 1 (1.32%) | 1 (1.96%) | 1 (5.56%) | 0 (0.00%) | | |
| Family History of High BP | 61 (18.05%) | 27 (16.77%) | 11 (14.67%) | 16 (18.60%) | 26 (20.63%) | 11 (22.00%) | 15 (19.74%) | 8 (15.69%) | 3 (16.67%) | 5 (15.15%) | | |
| Smoking | 25 (7.40%) | 12 (7.45%) | 5 (6.67%) | 7 (8.14%) | 12 (9.52%) | 5 (10.00%) | 7 (9.21%) | 1 (1.96%) | 1 (5.56%) | 0 (0.00%) | | |
| Alcohol Consumption | 12 (3.55%) | 9 (5.59%) | 6 (8.00%) | 3 (3.49%) | 3 (2.38%) | 1 (2.00%) | 2 (2.63%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | | |
| Physical Inactivity | 172 (52.12%) | 79 (51.63%) | 27 (37.50%) | 52 (64.20%) | 70 (55.56%) | 21 (42.00%) | 49 (64.47%) | 23 (45.10%) | 8 (44.44%) | 15 (45.45%) | | |
| Participation in Sport | 158 (48.92%) | 74 (50.68%) | 45 (66.18%) | 29 (37.18%) | 56 (44.44%) | 29 (58.00%) | 27 (35.53%) | 28 (54.90%) | 10 (55.56%) | 18 (54.55%) | | |
| Overweight | 28 (8.31%) | 9 (5.63%) | 1 (1.33%) | 8 (9.41%) | 11 (8.73%) | 3 (6.00%) | 8 (10.53%) | 8 (15.69%) | 0 (0.00%) | 8 (24.24%) | | |
| Obesity | 10 (2.97%) | 6 (3.75%) | 4 (5.33%) | 2 (2.35%) | 2 (1.59%) | 0 (0.00%) | 2 (2.63%) | 2 (3.92%) | 0 (0.00%) | 2 (6.06%) | | |
| Elevated Blood Pressure | 19 (5.62%) | 11 (6.83%) | 6 (8.00%) | 5 (5.81%) | 5 (3.97%) | 1 (2.00%) | 4 (5.26%) | 3 (5.88%) | 0 (0.00%) | 3 (9.09%) | | |
| Elevated Blood Glucose | 2 (0.59%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 1 (1.59%) | 0 (0.00%) | 1 (2.00%) | 1 (1.32%) | 0 (0.00%) | 0 (1.92%) | | |

Learners in Belhar (Table 4.5c) reported the highest frequency of both first- and second-degree diabetic relatives at 29 (18.01%) and 54 (33.54%) respectively with girls having the highest frequency. These girls reported a frequency of 19.77% and 36.05% for first- and second-degree diabetic relatives respectively.

Boys in all the locations had higher prevalence rates of heart problems in comparison to girls. At 7.45%, heart problems were more common amongst learners in Belhar, with boys demonstrating the highest frequency.

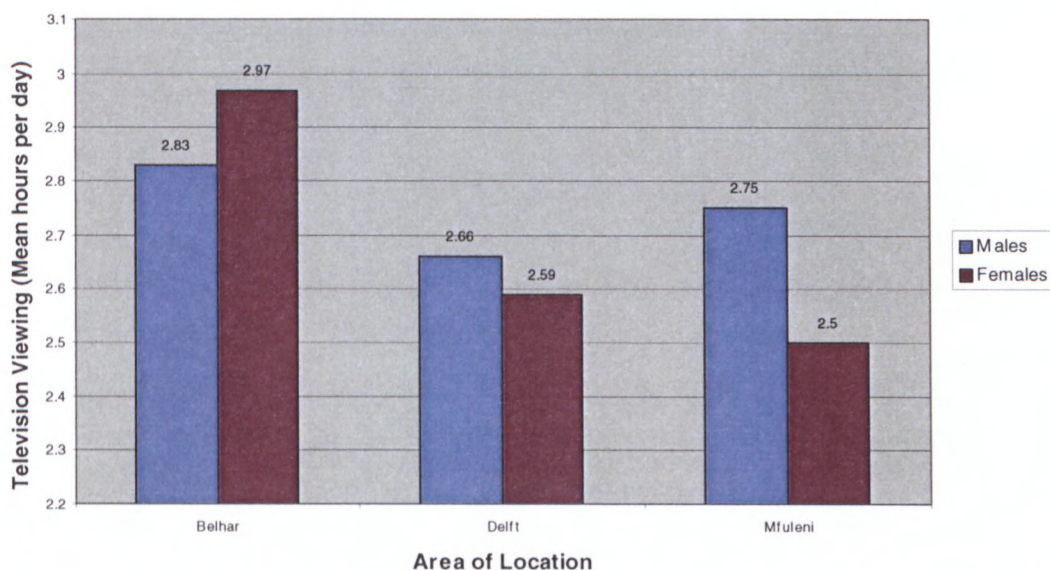
Learners in Delft (9.52%) were more inclined to smoke compared to learners residing in Belhar (7.45%) and Mfuleni (1.96%), with boys in Delft reporting the highest rate of smoking (10.00%).

Alcohol ingestion occurred mainly amongst learners in the community of Belhar (5.59%), with boys having the highest prevalence. Learners in Delft (Table 4.5c) demonstrated the highest prevalence for physical inactivity (55.56%). This was particularly observed amongst girls.

In an attempt to obtain meaningful information on the physical activity patterns of the subjects, variables such as television viewing and participation in sports were evaluated. Overall learners in Mfuleni showed the highest frequency of participation in sport. Coloured boys in Delft (63.00%) had the highest rate for participation in sports (Table 4.5c). To obtain information on time spent on sedentary behaviour, the hours learners spent watching television was assessed. A comparison of the amount of hours learners spent viewing television in the various areas of location, is presented in Fig 4.1. On average, boys watched television for almost three hours (2.76 ± 1.72), while girls had a

mean value of 2.74 hours (± 1.93) per day. Learners from Belhar spent more time watching television than those from Delft and Mfuleni. Unlike Delft or Mfuleni where boys watched more television, this pattern was reversed in Belhar (Figure 4.1).

Figure 4.1 Comparison of Television Viewing (hours per day) Amongst Learners Attending School in Belhar, Delft and Mfuleni



4.2.3.2 Dietary Patterns

Poor diet was defined as eating away from home (restaurants, take-aways, and cafés) more than three times per week. Ten (7.35%) of all boys and 7(3.85%) of all girls ate away from home more than three times per week. Mean daily and weekly intakes of the various items in the dietary assessment instrument were also assessed, but the majority of the items demonstrated a distribution of less than one. Stratifying the items into healthy and unhealthy food also did not yield meaningful information (*Annex 10*). Analyses revealed an insignificant relationship between consumption of soft drinks and both overweight and obesity ($p > 0.05$). The same was observed for other sweetened

beverages as shown in *Annex 10*.

4.2.4 The Physical and Physiological Characteristics of the Learners by Race and Gender

A table 4.6 - Table 4.11 illustrates the appropriate measures of central tendencies and their associated measure of variability for the physical and physiological characteristics of learners and is further stratified according to gender, race and area of location.

4.2.4.1 The Physical Characteristics

The measures of central tendency and the associated measure of variability for the physical characteristics of the males and female learners are presented in Tables 4.6, 4.7 and Table 4.8, where data has been stratified by age, gender, race and area of location. The distribution patterns of the physical characteristics of the research subjects were as follows:

4.2.4.1.1 Body Height, Body Weight, Body Mass Index

In the sample population, girls demonstrated higher body heights than boys (Table 4.6). Girls in the 10-11 and 12-13 year age groups had significantly higher values for body weight compared to their male counterparts ($p=0.0204$ and $p=0.0009$ respectively). No gender specific significant differences were observed in the body weights of learners in the age categories 14-15 ($p=0.3495$) and 16 years ($p=0.263$).

Table 4.6 The Physical Characteristics Of Boys and Girls In Belhar, Delft and Mfuleni, Stratified by Age and Gender

| Variability | Obs | Male | | Female | | p-value |
|---|-----|--------------------|-----------------------|--------------------|-----------------------|---------------------|
| | | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | |
| Body Weight (Kg) | | | | | | |
| 10 -11years | 90 | 30.6 | 5.8 | 33.3 | 12.4 | ^o 0.0204 |
| 12 -13 years | 82 | 34.2 | 10 | 41.2 | 13 | 0.0009 |
| 14 -15 years | 83 | 41.5 | 13.6 | 45.2 | 18 | 0.3495 |
| 16 years | 83 | 50.2 | ± 8.25 | 52.76 | ± 11.05 | *0.263 |
| Body Height (m) | | | | | | |
| 10 -11years | 90 | 1.37 | ± 0.08 | 1.4 | 0.04 | 0.1152 |
| 12 -13 years | 82 | 1.42 | ± 0.08 | 1.48 | ± 0.09 | 0.0016 |
| 14 -15 years | 83 | 1.53 | ± 0.08 | 1.52 | ± 0.09 | 0.9163 |
| 16 years | 83 | 1.61 | ± 0.08 | 1.57 | ± 0.05 | 0.0115 |
| Body Mass Index (kg/m²) | | | | | | |
| 10 -11years | 90 | 16.15 | 2.55 | 17.2 | 4.2 | 0.0013 |
| 12 -13 years | 82 | 17.1 | 3.9 | 18.4 | 5.3 | 0.0425 |
| 14 -15 years | 83 | 18.15 | 3.7 | 19.2 | 7.2 | 0.5005 |
| 16 years | 83 | 18.7 | 1.85 | 21.39 | ± 3.79 | 0.0035 |

^oMann-Whitney Ranksum Test probability values

*T-test probability values

Girls aged 12-13 years were significantly taller than boys in the same age group ($p=0.0016$). Though insignificant differences existed in the 10-11 and 14-15 year age groups ($p>0.05$), 16-year-old boys were significantly taller than their female counterparts.

Similar to the weight patterns observed girls also had significantly higher body mass indices (BMI) than males in all age groups except in the 10-11 ($p=0.0013$) and 14-15 year age group ($p=0.0035$). Significant differences were observed between boys and girls in the 10-11 year age group. A borderline significant difference was seen in the age category for 12-13-year-old learners. Results also illustrated significantly higher ($p=0.0035$) body mass index values for 16-year-old girls.

Table 4.7 presents the comparison of the Black and Coloured learners within the specified age categories. Though Black learners had higher body weights in all age

categories, these were not statistically different except in the 16-year age group.

Table 4.7 Distributions of Physical Characteristics of Learners Attending School in Belhar, Delft and Mfuleni, Stratified by Age & Race

| Variability | Obs | Black | | Coloured | | p-value |
|---|-----|--------------------|-----------------------|--------------------|-----------------------|---------|
| | | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | |
| Body Weight (Kg) | | | | | | |
| 10 -11years | 90 | 32.4 | 6.6 | 31.9 | 10.2 | 0.1192 |
| 12 -13 years | 82 | 35.6 | 11.2 | 37.2 | 15 | 1 |
| 14 -15 years | 83 | 49.62 | ± 12.12 | 41.6 | 13.8 | 0.1067 |
| 16 years | 83 | 56.74 | ± 8.97 | 47.8 | 10.2 | 0.0012 |
| Body Height (m) | | | | | | |
| 10 -11years | 90 | 1.37 | ± 0.07 | 1.39 | 0.11 | 0.2423 |
| 12 -13 years | 82 | 1.45 | ± 0.06 | 1.45 | ± 0.09 | 0.646 |
| 14 -15 years | 83 | 1.48 | 7 | 1.52 | ± 0.09 | 1.1033 |
| 16 years | 83 | 1.6 | ± 0.07 | 1.58 | ± 0.07 | 0.3147 |
| Body Mass Index (kg/m²) | | | | | | |
| 10 -11years | 90 | 17 | 4 | 16.55 | 3.4 | 0.0453 |
| 12 -13 years | 82 | 17.95 | 3.9 | 17.3 | 4.9 | 0.5158 |
| 14 -15 years | 83 | 19.95 | 6.4 | 18.2 | 4.9 | 0.0431 |
| 16 years | 83 | 22.16 | ± 3.40 | 18.7 | 2.8 | 0.0018 |

^oMann-Whitney Ranksum Test probability values

^{*}T-test probability values

No significant differences ($p > 0.05$) were observed in the body height of Black and Coloured learners in all age groups though Coloured learners in the sample were taller than Blacks in the 10-11 and 14-15 year age groups.

The body mass index of Black learners exceeded Coloured learners in all the age groups. Borderline significant differences were seen in the 10-11 ($p = 0.0453$) and 14-15 ($p = 0.0431$) year age groups. While an insignificant difference was found in 12-13-year-olds ($p = 0.5158$), a highly significant ($p = 0.0018$) difference was observed in the 16-year age group.

Table 4.8 Distributions of Physical Characteristics of Boys and Girls in Belhar, Delft and Mfuleni, by Age and Area of Location

| Variability | Obs | Belhar | | Delft | | Mfuleni | | p-value |
|---|-----|--------------------|-----------------------|--------------------|-----------------------|--------------------|-----------------------|----------|
| | | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | |
| Body Weight (Kg) | | | | | | | | |
| 10 -11years | 90 | 39.20 | 15.60 | 42.7 | ± 11.41 | 48.99 | ± 13.52 | *0.215 |
| 12 -13 years | 82 | 37 | 13.60 | 36.8 | 14.60 | 37.1 | 12.4 | ⊙ 0.8335 |
| 14 -15 years | 83 | 44.20 | 15.60 | 42.4 | 10.80 | 50.96 | ± 13.56 | *0.3978 |
| 16 years | 83 | 49.08 | ± 10.07 | 50.86 | ± 9.26 | 57.40 | ± 9.64 | 0.0114 |
| Body Height (m) | | | | | | | | |
| 10 -11years | 90 | 1.39 | ± 0.10 | 1.38 | ± 0.07 | 1.40 | ± 0.05 | *0.6859 |
| 12 -13 years | 82 | 1.46 | ± 0.10 | 1.46 | ± 0.08 | 1.44 | ± 0.05 | *0.717 |
| 14 -15 years | 83 | 1.52 | ± 0.10 | 1.54 | ± 0.07 | 1.49 | ± 0.07 | 0.2043 |
| 16 years | 83 | 1.58 | ± 0.07 | 1.57 | ± 0.61 | 1.62 | ± 0.72 | 0.0752 |
| Body Mass Index (kg/m²) | | | | | | | | |
| 10 -11years | 90 | 16.65 | 3.50 | 16.8 | ± 2.61 | 20.59 | ± 5.73 | *0.1115 |
| 12 -13 years | 82 | 17.30 | 3.60 | 17.40 | 5.30 | 18.05 | 4.50 | 0.9884 |
| 14 -15 years | 83 | 18.70 | 5.70 | 18.20 | 4.10 | 21.80 | 8.40 | 0.1373 |
| 16 years | 83 | 18.50 | 2.40 | 20.61 | ± 3.35 | 21.94 | ± 3.57 | 0.0285 |

⊙ Kruskal-Wallis test probability values where medians are compared

*Kruskal wallis Test Probability Values in cases where the underlying assumptions of the bonferonnie test did not uphold.)

Learners in Mfuleni were heavier than learners in both the other locations in all age categories (Table 4.8). Though differences became highly significant only in the 16-year-old age group (p=0.0114). Body heights were observed to be similar in learners from Belhar, Delft and Mfuleni (p > 0.05). Though learners in Mfuleni had higher BMI values than learners in Belhar and Delft in all age categories, significant differences were found only for BMI of 16-year-old learners.

4.2.4.1.2 Circumferences and Ratios

The measures of central tendencies and their respective measures of variability for mid-upper arm circumference, waist circumference, hip circumference and waist-hip circumference ratio are illustrated in Table 4.9 - Table 4.11.

Table 4.9 Circumferences of Boys and Girls in Belhar, Delft and Mfuleni, by Age, Gender and Race

| Variability | Obs | Male | | Female | | p-value |
|--------------------------------------|-----|--------------------|-----------------------|--------------------|-----------------------|---------|
| | | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | |
| Mid-arm Circumference (cm) | | | | | | |
| 10 -11years | 90 | 19.08 | 2.3 | 20.62 | 5.8 | 0.0116 |
| 12 -13 years | 82 | 20.1 | 3.73 | 22.43 | 4.87 | 0.0105 |
| 14 -15 years | 83 | 21.93 | 3.88 | 21.8 | 5.53 | 0.7152 |
| 16 years | 83 | 23.24 | ± 2.05 | 24.82 | ± 3.28 | 0.0177 |
| Waist Circumference (cm) | | | | | | |
| 10 -11years | 90 | 57.47 | 5.08 | 60.43 | 8.37 | 0.0266 |
| 12 -13 years | 82 | 59.6 | 7.43 | 63.73 | 10.83 | 0.0218 |
| 14 -15 years | 83 | 63.98 | 9.43 | 62.9 | 12.6 | 0.2969 |
| 16 years | 83 | 65.38 | 4.27 | 66.7 | 11.53 | 0.3641 |
| Hip Circumference (cm) | | | | | | |
| 10 -11years | 90 | 69.55 | 7.73 | 75.72 | 14.33 | 0.0023 |
| 12 -13 years | 82 | 72.9 | 10.97 | 82.73 | 13.23 | 0.0005 |
| 14 -15 years | 83 | 79.38 | 9.03 | 84.33 | 14.9 | 0.0516 |
| 16 years | 83 | 83.69 | ± 5.41 | 90.88 | ± 8.27 | 0.0001 |
| Waist-Hip Circumference Ratio | | | | | | |
| 10 -11years | 90 | 0.83 | ±0.04 | 0.81 | 0.04 | 0.0037 |
| 12 -13 years | 82 | 0.82 | 0.06 | 0.79 | 0.05 | 0.0032 |
| 14 -15 years | 83 | 0.82 | ± 0.04 | 0.76 | 0.05 | 0.0001 |
| 16 years | 83 | 0.79 | 0.04 | 0.76 | ± 0.05 | 0.0001 |

^oMann-Whitney Ranksum Test probability values

*T-test probability values

Results for the circumferences displayed a similar pattern as that of body weight and body mass index. Girls consistently had significantly larger mid-upper arm circumferences than boys in all age groups except in the 14-15 year age group where males had a median of 21.93 cm with an inter-quartile range (IQR) of 3.88.

Boys demonstrated higher waist circumferences than girls only in the age category 14-15 year old age group. Differences in waist circumference were only significant in the 10-11 and 12-13 year age groups respectively.

Significantly larger hip circumferences were observed in girls compared to their male counterparts ($p < 0.05$) in all age groups except in the 14-15 year age group in whom female learners demonstrated a borderline insignificantly higher hip circumference value ($p=0.0516$).

Waist-hip circumference ratios were significantly higher in boys in all age groups and were found to decrease with age and became more significant (Table 4.9).

The comparison of circumference measurements of Black and Coloured learners is presented in Table 4.10.

Table 4.10 **Circumferences of Learners Attending School in Belhar, Delft and Mfuleni, by Age and Race**

| Variability | Obs | Black | | Coloured | | p-value |
|--------------------------------------|-----|--------------------|-----------------------|--------------------|-----------------------|---------------------|
| | | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | |
| Mid-arm Circumference (cm) | | | | | | |
| 10 -11years | 90 | 20.23 | 3.83 | 19.82 | 3.17 | 0.1869 |
| 12 -13 years | 82 | 21.7 | 3.6 | 21.57 | 5.15 | 0.9732 |
| 14 -15 years | 83 | 24.28 | ± 4.39 | 21.63 | 4.6 | 0.1663 |
| 16 years | 83 | 25.64 | ± 2.93 | 23.4 | 2.7 | 0.0106 |
| Waist Circumference (cm) | | | | | | |
| 10 -11years | 90 | 60.33 | 6.67 | 58.28 | 6.53 | 0.0488 |
| 12 -13 years | 82 | 62.48 | 7.13 | 61.3 | 11.5 | 0.5231 |
| 14 -15 years | 83 | 67.97 | 13.78 | 62.47 | 9.5 | 0.0181 |
| 16 years | 83 | 70.87 | ± 5.97 | 64.22 | 3.67 | 0.0007 |
| Hip Circumference (cm) | | | | | | |
| 10 -11years | 90 | 75.13 | 10.8 | 72.43 | 10.23 | 0.1218 |
| 12 -13 years | 82 | 77.5 | 12.07 | 77.32 | 14.07 | ^o 0.626 |
| 14 -15 years | 83 | 88.3 | ± 10.38 | 80.43 | 10.1 | 0.0573 |
| 16 years | 83 | 91.78 | ± 8.71 | 85.96 | ±7.00 | *0.0119 |
| Waist-Hip Circumference Ratio | | | | | | |
| 10 -11years | 90 | 0.81 | ± 0.05 | 0.81 | ± 0.04 | *0.2623 |
| 12 -13 years | 82 | 0.8 | ± 0.05 | 0.79 | 0.06 | 0.7453 |
| 14 -15 years | 83 | 0.79 | ± 0.05 | 0.77 | 0.06 | 0.4062 |
| 16 years | 83 | 0.77 | ± 0.05 | 0.77 | 0.05 | ^o 0.5377 |

^oMann-Whitney Ranksum Test probability values

*T-test probability values

Though Black learners demonstrated larger mid-upper arm circumference values in all age groups compared to Coloureds, a statistically significant difference (p=0.0049) was only observed amongst learners in the 16-year-old age group.

Compared to Coloured learners, Blacks demonstrated significantly higher waist circumference location statistics in all age groups except amongst 12-13-year-olds.

Black learners had higher hip circumferences but these differences were only significant ($p=0.0119$) in the 16-year-old age group. No statistical differences were observed in the waist-hip circumference ratios between Coloured and Black learners (Table 4.10).

Table 4.11 Circumferences of Boys and Girls in Belhar, Delft and Mfuleni by Age and Area of Location

| Variability | Obs | Belhar | | Delft | | Mfuleni | | p-value |
|--------------------------------------|-----|--------------------|-----------------------|--------------------|-----------------------|--------------------|-----------------------|---------|
| | | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | |
| Mid-arm Circumference (cm) | | | | | | | | |
| 10 -11years | 90 | 20.28 | 5.70 | 19.27 | 3.13 | 22.13 | ± 4.00 | 0.2725 |
| 12 -13 years | 82 | 21.30 | 4.57 | 21.9 | 5.77 | 21.58 | ± 3.24 | 0.8116 |
| 14 -15 years | 83 | 21.97 | 5.70 | 21.77 | 4.60 | 25.05 | 5.12 | 0.3146 |
| 16 years | 83 | 23.19 | ± 2.76 | 24.15 | ± 2.58 | 25.89 | ± 3.18 | 0.0049 |
| Waist Circumference (cm) | | | | | | | | |
| 10 -11years | 90 | 58.78 | 11.40 | 59.03 | ± 6.07 | 65.89 | ± 9.04 | 0.0901 |
| 12 -13 years | 82 | 61.17 | 9.20 | 62.8 | 11.53 | 62.86 | ± 5.84 | 0.7301 |
| 14 -15 years | 83 | 62.9 | 12.30 | 63.57 | 10.30 | 66.97 | 16.30 | 0.2406 |
| 16 years | 83 | 63.7 | 6.43 | 67.49 | ± 6.75 | 71.24 | ± 6.38 | 0.0259 |
| Hip Circumference (cm) | | | | | | | | |
| 10 -11years | 90 | 73.12 | 15.82 | 72.22 | ± 7.47 | 83.33 | ± 13.85 | 0.0191 |
| 12 -13 years | 82 | 76.73 | 12.13 | 80.53 | ± 11.31 | 80.97 | 12.38 | 0.7743 |
| 14 -15 years | 83 | 81.33 | 12.37 | 80.67 | 10.40 | 90.29 | ± 11.65 | 0.1815 |
| 16 years | 83 | 83.67 | 8.60 | 88.96 | ± 7.44 | 91.32 | ± 9.37 | 0.0228 |
| Waist-Hip Circumference Ratio | | | | | | | | |
| 10 -11years | 90 | 0.81 | ± 0.04 | 0.82 | ± 0.04 | 0.80 | ± 0.06 | 0.4234 |
| 12 -13 years | 82 | 0.79 | 0.06 | 0.81 | ± 0.05 | 0.79 | ± 0.03 | 0.4607 |
| 14 -15 years | 83 | 0.78 | 0.07 | 0.79 | ± 0.05 | 0.78 | ± 0.04 | 0.9788 |
| 16 years | 83 | 0.77 | ± 0.04 | 0.76 | ± 0.05 | 0.78 | ± 0.06 | 0.1778 |

© Kruskal-Wallis test probability values where medians are compared

*Kruskal wallis Test Probability Values in cases where the underlying assumptions of the bonferonnie test did not uphold.)

Learners in Mfuleni again demonstrated larger mid-upper arm circumference values than those in Belhar and Delft (Table 4.11). However, the only significant difference was observed amongst learners in the 16-year age group ($p=0.0049$).

Similar to mid-upper arm circumference, sixteen-year-old learners in Mfuleni demonstrated significantly larger waist circumference values ($p=0.0259$) than learners in Belhar and Delft. Though this trend was also seen with respect to hip circumference, it was extended to the 10-11-year-old age group (0.0191). In Contrast waist-hip circumference ratios were similar across all locations (Table 4.11).

4.2.4.1.3 Body Composition

The results of body fat distribution values are presented in Tables 4.12 - 4.17. Percentage body fat was found to be significantly higher in boys in the 10-11 and 12-13 year-old age groups. Thereafter it started to increase in girls and became significantly higher in the 16-year-old age group. An interesting observation was the steady decrease in percentage body fat with age amongst boys (Table 4.12).

Though Black learners presented with higher values in body fat percentage in nearly all the age categories (Table 4.13), no statistically significant differences were observed. Similar to the patterns observed in Table 4.12, percentage body fat decreased with age in both Blacks and Coloured learners. Compared to Blacks, total body fat was higher amongst 10-11 and 12-13-year-old Coloured learners, but lower in the 14-15 and 16-year age groups.

Table 4.12 Body Composition Of Learners in Belhar, Delft & Mfuleni by Age & Gender

| Variable | obs | Male | | Female | | p-value |
|--------------------------------------|-----|--------------------|-----------------------|--------------------|-----------------------|---------|
| | | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | |
| Percentage Body Fat (%) | | | | | | |
| 10 -11years | 90 | 38.75 | 24.15 | 28.32 | 7.2 | 0.0003 |
| 12 -13 years | 82 | 29.5 | 18.7 | 25.8 | 10.3 | 0.0133 |
| 14 -15 years | 83 | 23.15 | ± 7.72 | 23.8 | 9.1 | 0.4598 |
| 16 years | 83 | 13.78 | ± 5.70 | 25.25 | 8.5 | 0.0001 |
| Total Body Fat (Kg) | | | | | | |
| 10 -11years | 90 | 12.84 | ± 2.63 | 9.9 | 3.4 | 0.0001 |
| 12 -13 years | 82 | 10.1 | 3.7 | 9.4 | 5.4 | 0.3049 |
| 14 -15 years | 83 | 9.55 | 4 | 10.1 | 7.4 | 0.62 |
| 16 years | 83 | 6.76 | ± 2.74 | 12.15 | 7.8 | 0.0001 |
| Percentage Lean Body Mass (%) | | | | | | |
| 10 -11years | 90 | 59.1 | 19.35 | 71.65 | 7.2 | 0.0001 |
| 12 -13 years | 82 | 70.5 | 18.7 | 74.2 | 10.1 | 0.0125 |
| 14 -15 years | 83 | 76.85 | ± 7.73 | 76.2 | 8.1 | 0.4771 |
| 16 years | 83 | 86.23 | ± 5.70 | 74.75 | 8.5 | 0.0001 |
| Lean Muscle Mass (Kg) | | | | | | |
| 10 -11years | 90 | 18.75 | 11.75 | 25.38 | ± 7.74 | 0.0023 |
| 12 -13 years | 82 | 24.6 | 15.3 | 32.49 | ± 8.23 | 0.0007 |
| 14 -15 years | 83 | 36.26 | ± 11.74 | 35.55 | ± 8.15 | *0.8589 |
| 16 years | 83 | 43.43 | ± 8.19 | 39.35 | ± 6.42 | 0.0137 |

*Kruskal wallis Test Probability Values (ANOVA p< 0.05)

The measures of central tendencies and the associated variability statistics are presented in Table 4.13.

Table 4.13 Body Composition of Learners by Age and Race

| Characteristic | Obs | Black | | Coloured | | p-value |
|--------------------------------------|-----|--------------------|-----------------------|--------------------|-----------------------|---------|
| | | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | |
| Percentage Body Fat (%) | | | | | | |
| 10 -11years | 90 | 29.98 | ± 6.66 | 33.85 | 17.4 | 0.1506 |
| 12 -13 years | 82 | 27.94 | ± 7.43 | 27.15 | 11.75 | 0.9331 |
| 14 -15 years | 83 | 25.55 | 8.75 | 22.4 | 9.4 | 0.1712 |
| 16 years | 83 | 24.75 | 14.7 | 20.6 | ± 7.14 | 0.7273 |
| Total Body Fat (Kg) | | | | | | |
| 10 -11years | 90 | 9.7 | 4.6 | 11.73 | ± 2.87 | 0.2151 |
| 12 -13 years | 82 | 9.65 | 2.7 | 10.05 | 5.25 | 0.7326 |
| 14 -15 years | 83 | 10.15 | 6.25 | 9.3 | 5.3 | 0.0465 |
| 16 years | 83 | 12.33 | ± 6.24 | 9.2 | 4.6 | 0.4041 |
| Percentage Lean Body Mass (%) | | | | | | |
| 10 -11years | 90 | 71.5 | 5 | 65.45 | 19.5 | 0.164 |
| 12 -13 years | 82 | 72.09 | ± 7.39 | 72.85 | 11.75 | 0.9242 |
| 14 -15 years | 83 | 74.4 | 8.15 | 77.6 | 9.4 | 0.1797 |
| 16 years | 83 | 75.25 | 14.7 | 79.4 | 9.4 | 0.7273 |
| Lean Muscle Mass (Kg) | | | | | | |
| 10 -11years | 90 | 25.24 | ± 6.72 | 22.43 | ± 9.41 | 0.0888 |
| 12 -13 years | 82 | 25.95 | 11.8 | 29.16 | ± 10.74 | 0.8975 |
| 14 -15 years | 83 | 36.65 | ± 7.58 | 35.56 | ± 10.23 | 0.4214 |
| 16 years | 83 | 44.25 | ± 9.78 | 106.52 | ± 11.10 | 0.0493 |

Insignificant differences were observed between the percentage lean muscle mass of Black and Coloured learners in all age groups. Comparison of lean muscle mass revealed the same insignificant trend in all age categories, except in the 16-year-old age group where a borderline significant difference was observed (Table 4.13).

No significant differences were observed in the distributions of percentage body fat amongst learners from Mfuleni, Belhar and Delft ($p > 0.05$) in all age groups (Table 4.14) although learners from Mfuleni had higher percentage body fat distributions.

Table 4.14 Distributions of Body Composition of Learners by Age and Race According to Location

| Characteristic | Obs | Belhar | | Delft | | Mfuleni | | p-value |
|---------------------------------|-----|--------------------|-----------------------|--------------------|-----------------------|--------------------|-----------------------|---------|
| | | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | |
| Percentage Body Fat (%) | | | | | | | | |
| 10 -11years | 90 | 31.9 | 17.3 | 31.4 | 12.4 | 27.05 | ± 6.08 | 0.1701 |
| 12 -13 years | 82 | 27 | 12.9 | 27.2 | 2.7 | 29.5 | ± 9.56 | 0.9272 |
| 14 -15 years | 83 | 23.9 | 12.3 | 22.54 | ± 7.12 | 27.3 | 9.3 | 0.1189 |
| 16 years | 83 | 19.48 | ± 7.67 | 22.51 | ± 6.45 | 20.39 | ± 9.28 | □0.2873 |
| Total Body Fat (Kg) | | | | | | | | |
| 10 -11years | 90 | 11.98 | ± 2.82 | 10.77 | ± 2.58 | 11.45 | 12 | 0.1928 |
| 12 -13 years | 82 | 9.8 | 6.6 | 10.5 | 5.1 | 10.08 | ± 3.97 | 0.5495 |
| 14 -15 years | 83 | 9.7 | 5.1 | 9.6 | 5 | 10.2 | 8.7 | 0.1727 |
| 16 years | 83 | 8.7 | 4 | 11.53 | ± 4.44 | 11.87 | ± 6.63 | 0.218 |
| Perc. Lean Body Mass (%) | | | | | | | | |
| 10 -11years | 90 | 67.05 | 18.7 | 68.6 | 15 | 72.95 | ± 6.08 | 0.1471 |
| 12 -13 years | 82 | 73 | 12.9 | 72.8 | 8 | 70.55 | ± 9.52 | 0.9292 |
| 14 -15 years | 83 | 76.1 | 12.3 | 77.46 | ± 7.11 | 73.1 | 9.3 | 0.1285 |
| 16 years | 83 | 80.52 | ± 7.67 | 77.49 | ± 6.46 | 79.62 | ± 9.28 | 0.2882 |
| Lean Muscle Mass (Kg) | | | | | | | | |
| 10 -11years | 90 | 23.58 | ± 10.36 | 20.97 | ± 6.52 | 29.36 | ± 7.69 | *0.0899 |
| 12 -13 years | 82 | 29.61 | ± 11.70 | 29.45 | ± 10.04 | 27.63 | ± 8.92 | 0.8482 |
| 14 -15 years | 83 | 36.95 | ± 11.60 | 34.59 | ± 8.17 | 40 | 14.4 | 0.576 |
| 16 years | 83 | 39.76 | ± 7.02 | 39.33 | ± 7.32 | 45.28 | ± 6.63 | 0.0087 |

*Kruskal Wallis test probability value employed were the assumptions for the ANOVA (Bonferonni) test did not hold

□ ANOVA probability value

Total body fat in kilograms displayed a similar pattern to the distribution pattern found in body fat percentage distribution values within the areas of location. Learners in Mfuleni demonstrated insignificantly higher mean values for total body fat in all the age groups except the 10-11-year-olds, in whom learners from Belhar had the highest mean (11.98 ± 2.82).

Percentage lean body mass did not differ significantly amongst learners from the different locations. No significant differences in lean muscle mass were observed in all age groups except in the 16-year-old age group. Sixteen-year-old learners in Mfuleni had significantly (p=0.0087) more lean muscle mass than learners in Belhar, Delft and Mfuleni

4.2.4.2 The Physiological Characteristics of the Populations

The distributions of the physiological parameters are presented in Tables 4.9, 4.10 & 4.11. The physiological parameters assessed in the sample population included the systolic- and diastolic blood pressures, blood glucose and cholesterol. Data was stratified by gender, race and area of location.

Table 4.15 Physiological Characteristics of Learners by Age and Gender

| Variable | obs | Male | | Female | | p-value |
|--|-----|--------------------|-----------------------|--------------------|-----------------------|---------|
| | | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | |
| Systolic Blood Pressure (mmHg) | | | | | | |
| 10 -11years | 90 | 97.47 | ± 12.00 | 101.99 | ± 14.20 | 0.112 |
| 12 -13 years | 82 | 97.81 | ± 13.70 | 103.82 | ± 13.16 | 0.0463 |
| 14 -15 years | 83 | 105.07 | ± 13.14 | 100 | 17.33 | 0.2479 |
| 16 years | 83 | 110.32 | ± 9.66 | 106.99 | ± 11.59 | 0.1783 |
| Diastolic Blood Pressure (mmHg) | | | | | | |
| 10 -11years | 90 | 62.06 | ± 10.98 | 64.14 | ± 9.75 | 0.344 |
| 12 -13 years | 82 | 60.4 | ± 9.28 | 61.33 | 14.67 | 0.1581 |
| 14 -15 years | 83 | 64.74 | ± 11.07 | 62.17 | ± 9.16 | 0.2548 |
| 16 years | 83 | 62.18 | ± 7.54 | 63.75 | ± 8.76 | 0.4034 |
| Blood Glucose (mmol/L) | | | | | | |
| 10 -11years | 90 | 4.22 | ± 0.73 | 4.7 | ± 0.80 | 0.0042 |
| 12 -13 years | 82 | 4.4 | ± 0.76 | 4.52 | ± 0.83 | 0.486 |
| 14 -15 years | 83 | 4.25 | 0.9 | 4.38 | ± 0.56 | 0.9815 |
| 16 years | 83 | 4.62 | ± 0.87 | 4.31 | ± 0.87 | 0.0901 |
| Blood Cholesterol (mmol/L) | | | | | | |
| 10 -11years | 90 | 3.96 | 0.62 | 3.88 | 0.4 | 0.4698 |
| 12 -13 years | 82 | 3.88 | 0.39 | 3.9 | 0.61 | 0.6947 |
| 14 -15 years | 83 | 3.93 | 0.52 | 3.9 | 0.51 | 0.9815 |
| 16 years | 83 | 3.88 | 0.11 | 3.88 | 0.5 | 0.1381 |

*Kruskal wallis Test Probability Values (ANOVA p< 0.05)

Girls generally had higher (though not significant) systolic blood pressures in the 10-11 and 12-13 age groups (Table 4.15). The reverse was observed in boys in the older age groups. Systolic blood pressures in learners were not statistically different except in the 12-13 year age group. Girls in the 12-13 year age group demonstrated borderline significantly higher systolic blood pressures (p=0.0463).

Girls presented higher values for diastolic blood pressure in all age groups excluding the

age group for 14-15 years of age. These differences were not of any significance in either of the age groups ($p > 0.05$).

Girls demonstrated higher blood glucose concentrations than boys in all age groups excluding the 16-year-old age groups. Girls aged 10-11 years demonstrated significantly higher ($p=0.0042$) blood glucose concentration than boys in the same age group. No significant differences in blood glucose concentration were observed in all the other age groups ($p > 0.05$). Though boys presented with higher blood cholesterol concentrations, none of these differences were significant ($p > 0.05$).

While 10-11 and 12-13-year-old Black learners demonstrated higher systolic blood pressure levels, Coloured learners presented higher values in the older age categories (Table 4.16). A borderline significant difference in systolic blood pressure of Black and Coloured learners was only observed amongst the 16-year-olds ($p=0.0493$).

Table 4.16 Distributions of Physiological Characteristics of Learners by Age and Race

| Variable | obs | Black | | Coloured | | p-value |
|--|-----|--------------------|-----------------------|--------------------|-----------------------|---------|
| | | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | |
| Systolic Blood Pressure (mmHg) | | | | | | |
| 10 -11years | 90 | 100.12 | ± 14.39 | 99.74 | ± 13.21 | 0.502 |
| 12 -13 years | 82 | 100.52 | ± 14.17 | 98.83 | 16 | 0.8227 |
| 14 -15 years | 83 | 102.95 | ± 11.64 | 103 | 22.33 | 0.9068 |
| 16 years | 83 | 111.82 | ± 9.78 | 106.52 | ± 11.10 | 0.0493 |
| Diastolic Blood Pressure (mmHg) | | | | | | |
| 10 -11years | 90 | 65.09 | ± 9.60 | 62.51 | ± 10.44 | 0.2629 |
| 12 -13 years | 82 | 61.81 | ± 13.24 | 59.5 | 12.33 | 0.5341 |
| 14 -15 years | 83 | 57.17 | 12.67 | 63.92 | ± 9.54 | 0.0989 |
| 16 years | 83 | 64 | ± 7.22 | 62.78 | ± 8.93 | 0.3579 |
| Blood Glucose (mmol/L) | | | | | | |
| 10 -11years | 90 | 4.67 | ± 0.73 | 4.43 | ± 0.83 | 0.421 |
| 12 -13 years | 82 | 4.36 | ± 0.58 | 4.49 | ± 0.85 | 0.4908 |
| 14 -15 years | 83 | 4.26 | ± 0.51 | 4.47 | ± 0.66 | 0.1583 |
| 16 years | 83 | 4.26 | ± 0.76 | 4.53 | ± 0.81 | 0.4294 |
| Blood Cholesterol (mmol/L) | | | | | | |
| 10 -11years | 90 | 3.88 | 0.12 | 3.95 | 0.62 | 0.3754 |
| 12 -13 years | 82 | 3.88 | 0.12 | 4.03 | 0.79 | 0.0833 |
| 14 -15 years | 83 | 3.98 | 0.71 | 3.88 | 0.36 | 0.3969 |
| 16 years | 83 | 3.88 | 0 | 3.88 | 0.52 | 0.2397 |

Similar to systolic blood pressure, Black learners presented higher diastolic blood pressure levels in all categories besides the group for 14-15-year-olds. (Table 4.16) Though Blacks had higher values, none of the differences in diastolic blood pressure were found to be significant ($p > 0.05$).

Coloured learners presented higher mean blood glucose concentration values in all age groups, except the group for 10-11-year-old learners. Differences in blood glucose concentration between Black and Coloured learners were found to be insignificant ($p > 0.05$). No difference was also observed in the blood cholesterol concentrations of Black and Coloured learners.

Table 4.17 Physiological Characteristics of Learners by Age and Area of Location

| Variable | Obs | Belhar | | Delft | | Mfuleni | | p-value |
|----------------------------------|-----|-----------------------|--------------------------|-----------------------|--------------------------|-----------------------|--------------------------|---------|
| | | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | Location Statistic | Variability Statistic | |
| Systolic BP (mmHg) | | | | | | | | |
| 10 -11years | 90 | 100.79 | ± 13.41 | 97.09 | ± 11.08 | 103.71 | ± 19.41 | 0.3657 |
| 12 -13 years | 82 | 95.67 | 16 | 98.67 | 20 | 100.69 | ± 12.42 | 0.5805 |
| 14 -15 years | 83 | 101.33 | 23 | 103.77 | ± 10.76 | 95.67 | 27 | 0.8041 |
| 16 years | 83 | 104.76 | ± 9.74 | 109.52 | ± 11.92 | 111.72 | ± 10.04 | 0.0598 |
| Diastolic BP (mmHg) | | | | | | | | |
| 10 -11years | 90 | 63.58 | ± 10.84 | 61.86 | ± 8.62 | 65.04 | ± 12.26 | 0.6844 |
| 12 -13 years | 82 | 59.33 | 11 | 62.67 | ± 9.68 | 62.83 | ± 14.16 | 0.8745 |
| 14 -15 years | 83 | 64.85 | ± 11.09 | 62.67 | ± 7.81 | 59.45 | ± 12.19 | 0.2726 |
| 16 years | 83 | 59.92 | ± 7.68 | 66.67 | ± 8.77 | 62.5 | ± 6.36 | 0.004 |
| Blood Glucose (mmol/L) | | | | | | | | |
| 10 -11years | 90 | 4.4 | ± 0.83 | 4.61 | ± 0.76 | 4.64 | ± 0.81 | 0.4758 |
| 12 -13 years | 82 | 4.52 | ± 0.94 | 4.51 | ± 0.68 | 4.16 | ± 0.44 | *0.266 |
| 14 -15 years | 83 | 4.37 | ± 0.71 | 4.43 | ± 0.61 | 4.49 | ± 0.41 | 0.6302 |
| 16 years | 83 | 4.14 | ± 0.49 | 4.23 | ± 0.8 | 3.89 | ± 0.05 | 0.0064 |
| Blood Cholesterol(mmol/L) | | | | | | | | |
| 10 -11years | 90 | 3.88 | 0.54 | 3.94 | 0.48 | 3.89 | 0.07 | 0.9097 |
| 12 -13 years | 82 | 3.88 | 0.39 | 4.09 | 0.92 | 3.88 | 0.22 | 0.2682 |
| 14 -15 years | 83 | 4.02 | 0.51 | 3.88 | 0.22 | 4 | 0.69 | 0.2596 |
| 16 years | 83 | 3.88 | 0.22 | 4.1 | 0.77 | 3.88 | 0 | 0.0064 |

Systolic blood pressure levels were similar in Belhar, Delft and Mfuleni in all age groups (Table 4.17). A borderline insignificant difference (ANOVA, $p=0.0598$) was observed amongst 16 year old learners. Significantly higher ($p=0.004$) diastolic blood pressure

values were only observed in 16-year-old learners residing in Delft. Sixteen-year-old learners in Belhar demonstrated significantly higher ($p=0.0064$) blood glucose concentrations compared to learners in the remaining areas. Insignificant differences in blood glucose concentration between the areas of location were observed in all other age groups ($p > 0.05$).

4.2.5 THE PREVALENCE OF THE OUTCOMES

The prevalence rates for the two primary and secondary outcome variables (overweight and obesity, and elevated blood pressure and glucose respectively), are illustrated in Table Figures 4.18a and 4.18b on page 125, and have been stratified by race, gender and area of location.

Table 4.18a Comparative Prevalence of Overweight and Obesity Amongst Boys and Girls Attending School in Belhar, Delft and Mfuleni, Using BMI as Criterion [Stratified by Race and Gender (n=338)]

| Race | Overweight | | Chi2 P=value | Obesity | | Chi2 p=value | Hypertension | | Chi2 p=value |
|-------------------------------------|-------------------------|-------------|-----------------|------------------------|-----------|-----------------|-------------------------|------------|-----------------|
| | Male | Female | | Male | Female | | Male | Female | |
| OVERALL PREVALENCE Totals | 4 (2.8%) 28 (8.31%) | 24 (12.37%) | 0.002 | 4 (2.8%) 10 (2.97%) | 6 (3.09%) | 1.000* | 7 (4.90%) 19 (5.62%) | 12 (6.15%) | 0.62 |
| BLACK Totals | 0 12 (13.79%) | 12 (23.08%) | 0.0001 | 1 (2.86%) 3 (3.45%) | 2 (3.85%) | 1.000* | 2 (5.71%) 5 (5.75%) | 3 (5.77%) | 1.000* |
| COLOURED Totals | 4 (3.74%) 16 (6.45%) | 12 (8.51%) | 0.13 | 3 (2.80%) 7 (2.82%) | 4 (2.84%) | 1.000* | 5 (4.67%) 14 (5.62%) | 9 (6.34%) | 0.572 |

Fisher's Exact

Table 4.18b Prevalence of Overweight and Obesity by Age, Gender and Race

| Characteristic | Obs | | Male | | Obs | | Female | |
|-------------------|-----------|-----------|-----------|-----------|-------------|------------|------------|-----------|
| | Obs | Coloured | Coloured | Black | Obs | Coloured | Coloured | Black |
| Overweight | | | | | | | | |
| 10 -11 years | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 2 (4.00%) | 1 (2.94%) | 1 (6.25%) | 0 (0.00%) |
| 12 -13 years | 1 (2.56%) | 1 (3.57%) | 0 (0.00%) | 0 (0.00%) | 5 (11.63%) | 5 (13.89%) | 0 (0.00%) | 0 (0.00%) |
| 14 -15 years | 2 (6.25%) | 2 (8.33%) | 0 (0.00%) | 0 (0.00%) | 5 (9.80%) | 2 (5.13%) | 3 (25.00%) | 0 (0.00%) |
| 16 years | 1 (3.13%) | 1 (5.26%) | 0 (0.00%) | 0 (0.00%) | 12 (24.49%) | 4 (12.50%) | 8 (47.06%) | 0 (0.00%) |
| Obesity | | | | | | | | |
| 10 -11 years | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 1 (2.00%) | 0 (0.00%) | 1 (6.25%) | 0 (0.00%) |
| 12 -13 years | 1 (2.33%) | 1 (2.78%) | 0 (0.00%) | 0 (0.00%) | 1 (2.33%) | 1 (2.78%) | 0 (0.00%) | 0 (0.00%) |
| 14 -15 years | 3 (6.25%) | 3 (7.69%) | 1 (8.33%) | 1 (8.33%) | 4 (7.84%) | 3 (7.69%) | 1 (8.33%) | 1 (8.33%) |
| 16 years | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) |

4.2.5.1 The Prevalence of Overweight and Obesity

The overall prevalence (using BMI) of overweight and obesity were observed in 8.31% (28) and 2.97% (10) of the learners respectively. Significantly higher ($p=0.002$) prevalence rates of overweight were observed in girls. In contrast, no significant difference was observed in the prevalence rates of obesity.

The highest prevalence rate (23.08%) for overweight was observed in Black girls, with particularly high values being observed in 16-year-old girls (47.06%) [Table 4.18b]. Fourteen to fifteen-year-old Coloured learners had the highest prevalence for overweight (3.74%) in males. None of the Black males were found to be overweight. Obesity was more prevalent amongst 14 to 15-year-old Black girls (8.33%) and boys (8.33%). Overweight was significantly more common (Fisher's, $p=0.0001$) amongst Black girls than their male counterparts. However, no significant differences the prevalence rates of Coloured boys and girls ($p=0.1300$).

Learners were also classified as overweight or obese using waist circumference and percentage body fat as criteria. The results are presented in Table 4.18c.

Table 4.18c Comparative Prevalence of Overweight and Obesity Amongst Learners in Belhar, Delft and Mfuleni by Race and Gender, Using Waist Circumference and Percentage Body Fat

| Criteria | Overweight | | Chi ² p=value | Obesity | | Chi ² p=value |
|---------------------------|------------|------------|-----------------------------|-------------|-----------|-----------------------------|
| | Male | Female | | Male | Female | |
| Waist Circumference (WC) | 1 (0.70%) | 13 (6.67%) | 0.007 | 1 (0.70%) | 4 (2.05%) | 0.309 |
| Percentage Body Fat (PBF) | * | * | * | 15 (10.49%) | 4 (2.06%) | 0.001 |

* No Overweight Category Generated for Percentage Body Fat

Overweight, as assessed by waist circumference was found in 6.67% of the girls and 0.70% boys in the study. This difference was found to be highly significant ($p=0.007$). Obesity was observed in only 0.70% of boys, while 2.05% of girls were obese. In contrast to overweight, no significant difference in the prevalence of obesity between boys and girls was observed ($p=0.3090$).

When using percentage body fat as a criterion, no subject was identified as being overweight (Table 4.18) (as outlined in chapter three in the definition). Girls demonstrated an obesity prevalence of 2.06%, while 10.49% of all boys were obese. A significant difference in the prevalence rates of obesity amongst boys and girls was observed (Fisher's, $p=0.0010$).

Significant correlations between waist circumference and body mass was observed identified. The correlation between body mass index and percentage body fat was no found to be significant.

The comparison of the prevalence rates of the various outcomes amongst the boys and girls in the different race groups are illustrated in Figure 4.2 and Figure 4.3.

Figure 4.2 clearly illustrates the higher prevalence rates for overweight, obesity and elevated blood pressure levels observed amongst girls.

Figure 4.2 The Prevalence of Overweight, Obesity, Elevated Blood Pressure and Glucose Intolerance (elevated blood glucose levels) in Boys and Girls

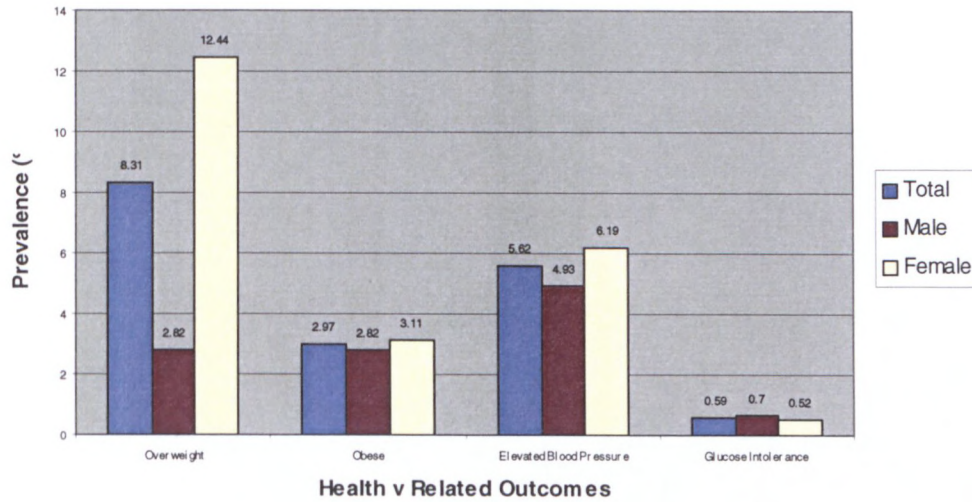
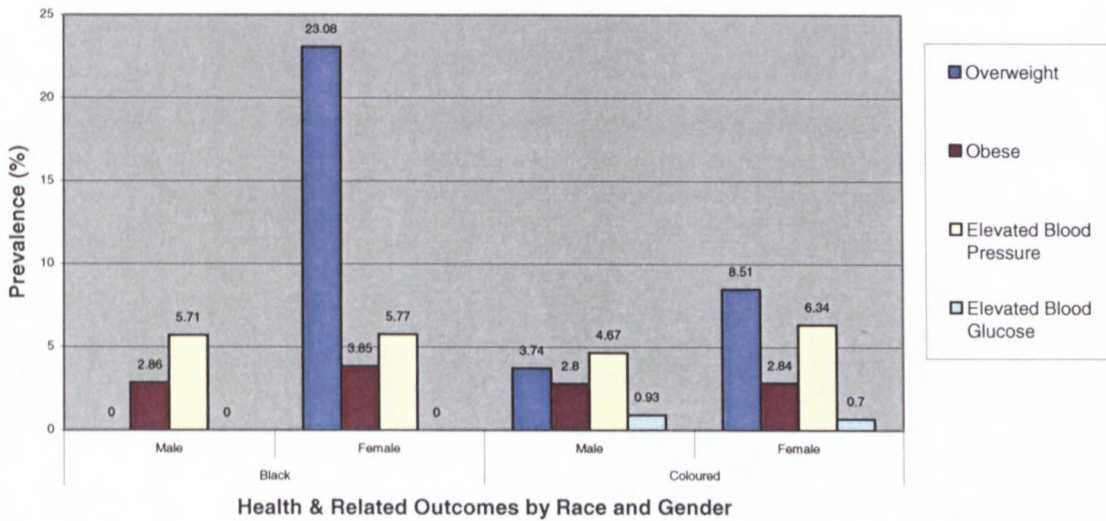


Figure 4.3 The Prevalence of Overweight and Obesity for the Different Genders By Race



When comparing the prevalence rates between the different residential locations, Mfuleni has the prevalence of obesity (3.92%).

4.2.5.2 Elevated Blood Glucose and Blood Pressure

The prevalence rates of elevated blood pressure and blood glucose are illustrated in Table 4.19.

4.2.5.2.1 Elevated Blood Pressure Levels

Table 4.19 Physiological Characteristics by Age, Gender and Race (n=338)

| Characteristic | Obs | Male | | Obs | Female | |
|--------------------------------|-----------|-----------|------------|------------|------------|------------|
| | | Coloured | Black | | Coloured | Black |
| Elevated Blood Pressure | | | | | | |
| 10 -11years | 2 (5.13%) | 2 (5.56%) | 0 (0.00%) | 3 (6.00%) | 2 (5.88%) | 1 (6.25%) |
| 12 -13 years | 2 (5.13%) | 1 (3.57%) | 1 (9.09%) | 6 (13.95%) | 5 (13.89%) | 1 (14.29%) |
| 14 -15 years | 3 (9.38%) | 2 (8.33%) | 1 (12.50%) | 2 (3.92%) | 1 (2.56%) | 1 (8.33%) |
| 16 years | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 1 (2.00%) | 1 (3.03%) | 0 (0.00%) |
| Elevated Blood Glucose | | | | | | |
| 10 -11years | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 1 (2.00%) | 1 (2.94%) | 0 (0.00%) |
| 12 -13 years | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) |
| 14 -15 years | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) |
| 16 years | 1 (3.13%) | 1 (5.26%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) | 0 (0.00%) |

The overall prevalence of elevated blood pressure (as defined by a systolic and diastolic blood pressure level above the 95th percentile) in the learners was 5.62% (Table 4.19). Elevated blood pressure was more common amongst girls (6.19%), with 12-13 year Black girls demonstrating the highest prevalence (14.29%). Amongst the 5.71% of males with elevated blood pressure levels, Black learners presented the highest frequency of elevated blood pressure. The highest prevalence rates were observed in 14-15 year old Black boys and in 12-13-year-old Black girls (12.50% and 14.29%) respectively. Elevated blood pressure was also more common amongst learners in Belhar.

4.2.5.2.2 Elevated Blood Glucose Concentrations

As illustrated by Table 4.20, the prevalence of elevated blood glucose concentrations within the overall sample population was 0.50%.

Table 4.20 The Prevalence of Elevated Blood Glucose Amongst Learners in Belhar, Delft and Mfuleni (n=338)

| Gender | Blood Glucose Status | | Total |
|--------------|----------------------|-----------|---------------|
| | Non-elevated | Elevated | |
| Male | 142 (99.30%) | 1 (0.70%) | 143 (100.00%) |
| Female | 194 (99.49%) | 1 (0.51%) | 195 (100.00%) |
| Total | 336 (99.41%) | 2 (0.50%) | 338 (100.00%) |

Probability > Chi² = 0.8250

Boys demonstrated the highest prevalence of elevated blood glucose concentrations (0.70%). The prevalence rates of elevated blood glucose concentrations between boys and girls in the sample population were not found to be significantly different (p=0.8250). 10-11-year-old girls demonstrated significantly higher mean concentrations of blood glucose (p=0.0042). Analyses in all the other age categories proved the gender differences to be highly insignificant (p > 0.05).

4.2.6 Associations Between Overweight, Obesity, Elevated Blood Pressure and Elevated Blood Glucose (Estimations in The Greater Population)

The prevalence of overweight and obesity with related conditions such as elevated blood pressure (hypertension) and elevated blood glucose concentration (glucose intolerance). Survey analyses were employed to determine whether any statistical difference existed between overweight and obesity, with elevated blood pressure and elevated blood glucose. This sections also attempts to compare various parameters of overweight and obese learners with those of normal weight.

4.2.6.1 Overweight and Elevated Blood Pressure

The findings pertaining elevated blood pressure levels in combination with overweight are also presented in Table 4.21a.

Table 4.21a Survey Estimations for The Prevalence of Elevated Blood Pressure Amongst Overweight Boys and Girls in Belhar, Delft and Mfuleni

| Overweight Status | | Blood Pressure (BP) Status | | Totals |
|-----------------------------------|--------|----------------------------|--------------|---------------|
| | | Non-elevated BP | Elevated BP | |
| 17 (89.47%) Non-Overweight | Male | 132 (41.51%) | 7 (36.84%) | 130 (41.25%) |
| | Female | 160 (50.31%) | 10 (52.63%) | 170 (50.45%) |
| 2 (10.53%) Overweight | Male | 4 (1.26%) | 0 (0%) | 4 (1.19%) |
| | Female | 22 (6.92%) | 2 (10.53%) | 24 (7.12%) |
| Totals | | 318 (100.00%) | 19 (100.00%) | 337 (100.00%) |

An overall prevalence rate of 10.53% was observed for overweight learners with elevated blood pressure. Two (10.53%) of the girls with elevated blood pressure were found to be overweight as well. None of the four overweight boys presented with elevated blood pressure levels.

The prevalence rate of overweight (8.31%) amongst learners in the study is estimated with 95% confidence to be between 4.78% and 11.81% (Table 4.21b) Furthermore, the prevalence rate of elevated blood pressure levels amongst overweight learners (10.53%) in the greater population was estimated with 95% confidence to be between 1.61% and 45.90%.

Table 4.21b Survey Estimations for The Prevalence of Elevated Blood Pressure Amongst Overweight Learners in Belhar, Delft and Mfuleni

| Overweight Status | Blood Pressure Status | | Total |
|-----------------------|--------------------------------------|------------------------------------|---|
| | Non-Elevated | Elevated | |
| Non-Overweight | 292 (91.82%) (CI: 87.89%, 94.56%) | 17 (89.47%) (CI: 54.10, 98.39%) | 309 (91.68%) (CI: 88.19%, 94.22%) |
| Overweight | 26 (8.18%) (CI: 5.44%, 12.11%) | 2 (10.53%) (CI: 1.61%, 45.90%) | 28 (8.31%) (CI: 5.78%, 11.81%) |
| Total | 318 (100.00%) | 19 (100.00%) | 337 (100.00%) |

Pearson Chi² = 0.7946

However, an insignificant association was observed between hypertension and overweight in this study ($p = 0.7946$).

The blood pressure status of overweight boys and girls in comparison to learners of normal weight is exhibited in Table 4.21c.

Table 4.21c Blood Pressure of Overweight Learners in Comparison to Normal-weight Learners

| | Boys (n = 143) | | Chi ² -Value | Girls (n = 194) | | Chi ² -Value |
|-------------|--------------------|--------------------------|-------------------------|---------------------|--------------------------|-------------------------|
| | Overweight (n = 4) | Non-Overweight (n = 139) | | Overweight (n = 24) | Non-overweight (n = 170) | |
| Elevated BP | 0 (0.0%) | 7 (5.04%) | 1.000 | 2 (8.33%) | 10 (5.88%) | 0.647 |

The blood pressure levels of overweight and normal weight boys and girls did not differ statistically ($p=1.000$ and $p=0.647$ respectively).

4.2.6.2 Obesity and Elevated Blood Pressure

The prevalence of elevated blood pressure in the presence of obesity is presented in Table 4.22a.

Table 4.22a Survey Estimations for The Prevalence of Elevated Blood Pressure Amongst Obese Boys and Girls in Belhar, Delft and Mfuleni

| Obesity Status | | Blood Pressure (BP) Status | | Totals |
|-----------------------|--------|----------------------------|---------------------|----------------------|
| | | Non-elevated BP | Elevated BP | |
| Non-Obese 15 (78.95%) | Male | 135 (42.45%) | 4 (21.05%) | 139 (41.25%) |
| | Female | 177 (55.66%) | 11 (57.89%) | 188 (55.79%) |
| Obese 4 (21.05%) | Male | 1 (0.31%) | 3 (15.79%) | 4 (1.19%) |
| | Female | 5 (1.57%) | 1 (5.26%) | 6 (1.78%) |
| Totals | | 318 (100.00%) | 19 (100.00%) | 337 (100.00%) |

Four (21.05%) of the nineteen learners with elevated blood pressure were also found to be obese (Table 4.22a). Three (15.79%) of them were male and 1(5.26%) was female.

The prevalence rate of obesity (2.97%) amongst learners in the study is estimated with 95% confidence to be between 1.57% and 5.54% (Table 4.22b). The prevalence rate of elevated blood pressure levels amongst obese learners (21.05%) in the greater population was estimated with 95% confidence to be between 7.77% and 45.79%.

Table 4.22b Survey Estimations for The Prevalence of Elevated Blood Pressure Amongst Obese Learners in Belhar, Delft and Mfuleni

| Obesity Status | Blood Pressure Status | | Total |
|----------------|---------------------------------------|------------------------------------|--|
| | Non-Elevated | Elevated | |
| Non-Obese | 312 (98.11%) (CI: 95.99%, 99.12%) | 15 (78.95%) (CI:54.21%, 92.23%) | 327 (97.3%) (CI: 94.46%, 98.43%) |
| Obese | 6 (1.89%) (CI: 0.88%, 4.01%) | 4 (21.05%) (CI: 7.77%, 45.79%) | 10 (2.97%) (CI: 1.57%, 5.54%) |
| Total | 318 (100.00%) | 19 (100.00%) | 337 (100.00%) |

Pearson Chi²= 0.0282

A statistically significant association was observed between elevated blood pressure and obesity amongst learners in this study (p = 0.0282).

The blood pressure status of obese learners in comparison to learners of normal weight is exhibited in Table 4.22c.

Table 4.22c Blood Pressure Status of Obese learners in Comparison to Normal-weight Learners

| Blood Pressure Status | Boys (n = 143) | | Chi ² -Value | Girls (n = 194) | | Chi ² -Value |
|-------------------------|----------------|---------------------|-------------------------|-----------------|---------------------|-------------------------|
| | Obese (n = 4) | Non-obese (n = 139) | | Obese (n = 24) | Non-Obese (n = 170) | |
| Elevated Blood Pressure | 3 (75.0%) | 4 (2.90%) | 0.000 | 1 (16.67%) | 11 (5.85%) | 0.322 |

The prevalence rates of elevated blood pressure in obese individuals in the population were not found to be significantly different ($p=0.0000$) in boys, but not in girls ($p=0.322$).

4.2.6.3 Elevated Blood Glucose Concentrations and Elevated Blood Pressure

The prevalence rates of elevated blood glucose concentrations and its association with elevated blood pressure within the sample population are presented in Table 4.23.

Table 4.23 Survey Estimations for The Prevalence of Elevated Blood Pressure Amongst Learners with Elevated Blood glucose in Belhar, Delft and Mfuleni

| Blood Pressure Status | Blood Glucose Status | | Total |
|-----------------------|--------------------------------------|-------------------------|--------------------------------------|
| | Non-Elevated | Elevated | |
| Non-Elevated | 317 (99.37%) (CI: 91.23%, 96.40%) | 2 (100.00%) (CI: 0%) | 319 (99.41%) (CI: 97.57%, 99.86%) |
| Elevated | 19 (0.63%) (CI: 0.15%, 2.57%) | 0 (0.00%) (CI: 0%) | 19 (5.62%) (CI: 0.14%, 12.43%) |
| Total | 336 (100.00%) | 2 (100.00%) | 337 (100.00%) |

Pearson Chi² = 0.7232

The prevalence rate of elevated blood glucose concentration amongst learners in the study is estimated with 95% confidence to be between 0.14% and 12.43% (Table 4.23). None of the individuals with elevated blood pressure levels presented with elevated blood glucose concentrations. Correspondingly the prevalence rate of elevated blood glucose levels amongst learners with elevated blood pressure in the greater population

was estimated with 95% confidence to be 0%. The relationship between elevated blood pressure and elevated blood glucose concentrations was found to be statistically insignificant ($p = 0.7232$).

The comparison of body composition, circumference and other measurements are displayed in Table 4.24a.

Table 4.24a Comparison of Overweight and Obese learners with learners of Healthy (Normal) Weight

| | Boys (n = 143) | | Girls (n = 194) | | Boys (n = 143) | | Girls (n = 194) | | Girls (n = 194) | | |
|---------------------|-----------------------|-----------------------------|------------------------|-----------------------------|------------------|------------------------|-------------------|------------------------|-------------------|------------------------|--------|
| | Overweight (n = 4) | Non-Overweight (n = 139) | Overweight (n = 24) | Non-overweight (n = 170) | Obese (n = 4) | Non-obese (n = 139) | Obese (n = 24) | Non-Obese (n = 170) | Obese (n = 24) | Non-Obese (n = 170) | |
| | | p-Value | | p-Value | | p-Value | | p-Value | | p-Value | |
| Elevated BP* | 0 (0.0%) | 7 (5.04%) | 1.000 | 2 (8.33%) | 10 (5.88%) | 0.647 | 3 (75.0%) | 4 (2.90%) | 1 (16.67%) | 11 (5.85%) | 0.322 |
| Body Mass Index | 27.1 (0.85) | 17.4 (3.2) | 0.0016 | 26.2 (2.6) | 18.2 (4.6) | 0.0000 | 32.05 (7.3) | 17.4 (3.2) | 34.95 (11.8) | 18.65 (6.0) | 0.0000 |
| % Body Fat | 25.8 (20.9) | 19.7 (1.6) | 0.1861 | 30.15 (3.95) | 24.65 (8.5) | 0.0000 | 27.4 (8.7) | 25.5 (20.9) | 42 (8.6) | 25.3 (8.5) | 0.0071 |
| Total Body Fat | 12.8 (1.7) | 9.7 (4.7) | 0.0501 | 19.65 (4.8) | 9.9 (3.9) | 0.0000 | 21.15 (13.2) | 9.7 (4.7) | 31.85 (13) | 10.2 (5.8) | 0.0042 |
| % Lean Body Mass | 80.3 (1.6) | 74.2 (21.1) | 0.1861 | 69.95 (4.35) | 75.35 (8.5) | 0.0000 | 72.6 (8.7) | 74 (21.1) | 58 (8.6) | 74.7 (8.4) | 0.0077 |
| Lean Muscle Mass** | 54.95 □ 4.74 | 29.96 □ 13.38 | 0.0003 | 44.57 □ 4.53 | 31.63 □ 8.56 | 0.0000 | 59.4 □ 5.66 | 29.82 □ 13.11 | 42.48 □ 7.43 | 32.93 □ 9.12 | 0.0120 |
| Waist Circumference | 83.86 (5.62) | 61.83 (9.07) | 0.0017 | 77.07 (7.8) | 62.27 (8.93) | 0.0000 | 93.83 (6.87) | 61.83 (9.17) | 87.47 (18.93) | 62.85 (11.88) | 0.0028 |
| Hip Circumference | 99.65 (2.28) | 76.6 (12.33) | 0.0015 | 99.87 (4.42) | 81.07 (13.03) | 0.0000 | 112.4 (8.85) | 76.6 (12.33) | 110.95 (11.67) | 83.62 (13.72) | 0.0019 |
| Elevated Glucose | 0 (0.0) | 0 (0.0) | 1.0 | 0 (0.0) | 0 (0.0) | 1.0 | 0 (0.0) | 0 (0.0) | 0 (0.0) | 0 (0.0) | 1.0 |
| Cholesterol Conc. | 3.94 (0.47) | 3.88 (0.44) | 0.9523 | 3.96 (0.6) | 3.88 (0.45) | 0.4903 | 5.17 (2.58) | 3.88 (0.4439) | 4.25 (0.76) | 3.88 (0.48) | 0.2354 |

*Pearson's Chi2-value

**Ttest probability value

Overweight males demonstrated significantly different body mass indices, lean muscle mass values, hip and waist circumferences than non-overweight male ($p < 0.05$). The blood pressure status, blood glucose levels and blood cholesterol levels were not found to be significantly different ($p > 0.05$).

Statistically significant differences were observed in the body composition parameters and circumferences of overweight girls and those of normal weight ($p < 0.0001$). Similar to overweight males, no differences were found in the cholesterol, glucose and blood pressure levels of overweight and non-overweight girls ($p > 0.05$).

Significant differences were only found between the body mass index, total body fat, lean muscle mass, and waist and hip circumferences of obese and non-obese boys ($p < 0.001$).

Obese girls exhibited significantly different body composition and circumferences in comparison to those that are non-obese ($p < 0.05$).

4.2.7 Physical Inactivity

As stated earlier, in Table 4.5a, 39.57% of the boys and 60.85% of girls were found to be physically inactive. The leisure time and sports activities of overweight and obese learners were compared to that of non-overweight and non-obese learners. The measures of central tendencies and variability, and the associated probability values are presented in Table 4.24b.

Though comparison of the time spent watching television (TV) showed that overweight boys spent more hours watching TV per day (3.5 ± 1.73) than non-overweight boys in

the sample, this was found to be insignificant ($p=0.5850$). Similar patterns were observed between overweight and non-overweight girls. Overweight girls spent more time watching TV than those non-overweight.

Amongst both boys and girls, non-overweight individuals spent less time exercising than overweight ones. While more overweight boys reported that they had no household chores than non-overweight boys, having no chores was more common amongst the non-overweight girls.

Obese boys spent more time on television viewing than those of normal weight. Contrary to this, obese girls spent less time watching TV than their non-obese counterparts. Physical inactivity was more prevalent amongst non-obese boys than obese ones. In contrast to this, physical inactivity was more common in obese girls in the study than those that were non-obese. Insignificant differences between overweight and non-overweight, and obese and non-obese learners were observed in all the leisure time and sports activities ($p > 0.05$).

Table 4.24b Comparative Distribution Table of Physical Activity and Physical Inactivity for Overweight, Obese, Non-overweight and Non-obese Learners

| | Males (n = 143) | | Females (n = 194) | | Males (n = 143) | | Females (n = 194) | | Chi ² - Value |
|-----------------------|------------------------|---------------------------------|--------------------------|---------------------------------|------------------------|----------------------------|--------------------------|----------------------------|-----------------------------|
| | Overweight (n = 4) | Non- Overweight (n = 139) | Overweight (n = 24) | Non- Overweight (n = 170) | Obese (n = 4) | Non- obese (n = 139) | Obese (n = 24) | Non- Obese (n = 170) | |
| TV Watching (>4 hpd)* | 3.5 □ 1.73 | 2.74 □ 1.72 | 2.92 □ 1.72 | 2.73 □ 1.96 | 3 □ 1.83 | 2.76 □ 1.72 | 2.74 □ 1.94 | 3.08 □ 1.56 | 0.3308 |
| Physical Inactivity | 0 (0%) | 56 (41.18%) | 13 (56.52%) | 102 (61.45%) | 1 (25.0%) | 55 (40.44%) | 5 (83.33%) | 110 (60.11%) | 0.7458 |
| No sports | 0 (0.0%) | 52 (39.39%) | 13 (56.52%) | 99 (60.74%) | 0 (0.0%) | 52 (30.10%) | 5 (83.33%) | 107 (59.44%) | 0.655 |
| Exercise (>1/never) | 1 (25.0%) | 47 (33.81%) | 13(12.5%) | 98 (57.65%) | 2 (50%) | 46 (33.09%) | 6 (100%) | 105 (55.85%) | 0.821 |
| Chores (none) | 1 (25.0%) | 27 (20.45%) | 1 (4.35%) | 10 (6.13%) | 0 (0%) | 11(6.11%) | 0 (0%) | 28 (6.06%) | 0.279 |
| | | | | | | | | | 1.000 |

*T-test probability values

4.2.8 Risk Factors Associated With The Outcomes

Risk factors were determined with the aid of simple logistic regression analysis and survey logistic regression analysis. Multiple logistic regression, stepwise multiple regression and survey logistic multiple regression analysis were also employed to generate the models for the risk factors which best predicted overweight, obesity, and elevated blood pressure. The risk factors of interest used to generate the predictive models, were chosen based on evidence found in available literature and stepwise variable selection procedures were employed in order to identify the best predictors for a specific outcome.

4.2.8.1 Risk Factors for Overweight and Obesity

The prevalence odds ratio for each respective risk factor was generated with the aid of simple logistic regression analyses techniques. The respective prevalence odds ratios, their 95% confidence intervals and the probability values for each risk factor are presented in Table 4.25a. The age-adjusted prevalence odds ratios are also presented in Table 4.25b.

4.2.8.1.1 Overweight

The results obtained from the simple logistic regression analysis for the identification of possible risk factors associated with overweight are illustrated in Table 4.25a. Analyses were also performed in order to adjust for the possible confounding effect of age.

Table 4.25a Simple Logistic Regression Analysis for Possible Risk Factors Associated With Overweight

| Risk Factor | Obs | Prevalence Odds Ratio | 95% Confidence Interval | p-value |
|-----------------------------------|-----|-----------------------|-------------------------|---------|
| Age (In years) | 337 | 1.44 | 1.16 - 1.80 | 0.001 |
| Gender | 337 | 4.91 | 1.66 - 14.47 | 0.004 |
| Race | 335 | 2.32 | 1.05 - 5.12 | 0.037 |
| Physical Inactivity | 329 | 0.85 | 0.38 - 1.86 | 0.678 |
| Television Viewing | 337 | 1.08 | 0.88 - 1.32 | 0.463 |
| Area of Location (Belhar as Base) | 337 | 1.76 | 1.05 - 2.93 | 0.031 |
| Delft | 126 | 1.60 | 0.64 - 4.00 | 0.310 |
| Mfuleni | 51 | 3.12 | 1.14 - 8.58 | 0.027 |
| Family History of High BP | 337 | 0.52 | 0.22 - 1.24 | 0.139 |
| Waist Circumference | 337 | 1.16 | 1.11 - 1.21 | 0.000 |
| Hip Circumference | 337 | 1.16 | 1.11 - 1.21 | 0.000 |
| Eating Out | 317 | 0.54 | 0.30 - 0.95 | 0.032 |
| Blood Cholesterol | 311 | 1.26 | 0.61 - 2.59 | 0.528 |
| Blood Glucose | 337 | 1.43 | 0.86 - 2.38 | 0.167 |

Age was found to be a significant ($p=0.001$) predictor of overweight within the study population. A 44% ($OR=1.44$, $95\% CI=1.16 - 1.80$) significant increased risk of being overweight was associated with age. A positive significant association also existed between overweight and gender ($p=0.004$). Girls were associated with an almost 5 fold significant increased risk of being overweight in comparison to boys ($OR=4.9$, $95\% CI=1.66 - 14.47$). Black learners had a 2-fold ($OR=2.32$, $95\% CI=1.05 - 5.12$) risk of being overweight in comparison to Coloured learners, while learners from Mfuleni had a 3-fold ($p=0.027$) significantly increased risk of being overweight, in comparison to those living in Belhar ($OR=3.12$, $CI=1.14 - 8.58$).

Both waist and hip circumference demonstrated a positive significant relationship with overweight ($p=0.000$ correspondingly). A 16% significant increased risk of being overweight was associated with an increase in both hip and waist circumference. A significant ($p=0.032$) 46% decreased risk was associated with poor dietary habits ($OR=0.54$, $95\% CI=0.30 - 0.95$). Though elevated blood concentrations of cholesterol and glucose demonstrated a significant relationship with overweight ($p>0.05$), the

relationships were found to be insignificant.

Physically inactivity was associated with an insignificant 15% decreased risk of overweight (OR=0.85, 95% CI=0.38 - 1.86). Though learners spending more time (>4-hours per day) watching television were at an 8% (OR=1.08, 95% CI=0.88 - 1.32) increased risk of overweight, this was not significant (p=0.463). While a family history of high blood pressure was associated with a 48% decreased risk of overweight (OR=0.52, 95% CI=0.22 - 1.24), this was again not significant (p=0.139)

An adjustment for the possible confounding effect of age (Table 4.25b) resulted in the loss of significance for risk factors such as race, as well as a decrease in the significance and odds ratio associated with area of location. When corrected for age, the odds ratio showed a 2-fold (OR=2.22) increased risk of overweight for learners in Mfuleni (Table 4.25b).

Table 4.25b Simple Logistic Regression Analysis for Possible Risk Factors Associated with Overweight Adjusted for Age

| Risk Factor | Obs | Adjusted Prevalence Odds Ratio | 95% Confidence Interval | p-value |
|-----------------------------------|-----|--------------------------------|-------------------------|---------|
| Gender | 337 | 4.65 | 1.56 - 13.87 | 0.006 |
| Race | 335 | 1.91 | 0.84 - 4.32 | 0.121 |
| Physical Inactivity | 329 | 0.88 | 0.39 - 1.97 | 0.760 |
| Television Viewing | 337 | 1.02 | 0.83 - 1.26 | 0.837 |
| Area of Location (Belhar as Base) | 337 | 1.48 | 0.88 - 2.52 | 0.143 |
| Delft | 126 | 1.38 | 0.55 - 3.50 | 0.493 |
| Mfuleni | 51 | 2.22 | 0.78 - 6.35 | 0.136 |
| Family History of High BP | 337 | 0.55 | 0.22 - 1.33 | 0.185 |
| Waist Circumference | 337 | 1.16 | 1.10 - 1.21 | 0.000 |
| Hip Circumference | 337 | 1.16 | 1.10 - 1.21 | 0.000 |
| Eating Out | 317 | 0.50 | 0.28 - 0.91 | 0.022 |
| Blood Cholesterol | 311 | 1.42 | 0.70 - 2.88 | 0.330 |
| Blood Glucose | 337 | 1.53 | 0.90 - 2.59 | 0.116 |

In summary, girls in general and in particular from Mfuleni have an increased risk for becoming overweight. Increases in waist and hip circumferences were associated with this increase. Black learners had a 2-fold risk of being overweight in comparison to Coloured learners.

In Tables 4.26a and 4.26b significant models for the prediction of overweight were generated with the aid of advanced survey multiple logistic analyses (probability > F-statistic = 0.0000) and stepwise multiple regression analyses (p=0.0000).

Table 4.26a Survey multiple logistic regression model for the prediction of overweight

Probability > F Statistic = 0.0001

| Risk Factor For Overweight | Prevalence Odds Ratio | 95% Confidence Interval | p-value |
|----------------------------|-----------------------|-------------------------|---------|
| Age | 1.32 | 1.03 - 1.70 | 0.030 |
| Gender | 7.33 | 1.336 - 40.197 | 0.023 |
| Waist Circumference | 1.17 | 1.09 - 1.26 | 0.000 |

Using a multiple regression model, the risk factors that best predicted overweight in the sample population was the age, gender and waist circumference (Table 4.26a). Age was associated with a significant (p=0.030) 32% increased risk (OR=1.32, 95% CI=1.029 - 1.700) while being a female was associated (p=0.030) with a more than 7-fold risk (OR=7.33, 95% CI=1.336 - 40.197), in comparison to males. An increase in waist circumference was associated with a 17% significant (p=0.000) risk of being overweight (OR=1.17, 95% CI=1.093 - 1.261).

The risk factors associated with overweight, as identified through stepwise multiple logistic regression are presented in Table 4.26b.

Table 4.26b Stepwise multiple logistic regression model for the prediction of overweight

Probability > Chi² = 0.0000

| Risk Factor For Overweight | Prevalence Odds Ratio | 95% Confidence Interval | p-value |
|----------------------------|-----------------------|-------------------------|---------|
| Age (Years) | 1.29 | 0.97 - 1.72 | 0.082 |
| Gender | 4.22 | 0.20 - 17.87 | 0.050 |
| Hip Circumference | 1.09 | 0.99 - 1.20 | 0.073 |
| Waist Circumference | 1.08 | 0.97 - 1.20 | 0.170 |

Stepwise multiple logistic regression analyses (Table 4.26b) did not demonstrate any of the risk factors to be significantly related to overweight, although the model itself was significant.

4.2.8.1.2 Obesity

The prevalence odds ratios for the possible risk factors associated with obesity were generated with the aid of simple logistic regression analysis. The respective odds ratios or each risk factor associated with obesity, and their respective 95% confidence intervals their probability values are presented in Table 4.27a.

Table 4.27a Simple Logistic Regression Analysis for Possible Risk Factors Associated With Obesity

| Risk Factor | Obs | Prevalence Odds Ratio | 95% Confidence Interval | p-value |
|---------------------------------------|-----|-----------------------|-------------------------|---------|
| Age (In years) | 337 | 0.96 | 0.68 - 1.35 | 0.806 |
| Gender | 337 | 1.11 | 0.31 - 4.00 | 0.874 |
| Race | 335 | 1.23 | 0.31 - 4.86 | 0.768 |
| Physical Inactivity | 329 | 1.40 | 0.39 - 5.06 | 0.608 |
| Television Viewing | 337 | 1.09 | 0.79 - 1.51 | 0.608 |
| Area of Location (Belhar as Base) | 337 | 0.86 | 0.35 - 2.11 | 0.734 |
| Delft | 126 | 0.41 | 0.82 - 2.09 | 0.285 |
| Mfuleni | 51 | 1.05 | 0.20 - 5.36 | 0.955 |
| Family History of High Blood Pressure | 337 | 0.50 | 0.13 - 2.00 | 0.330 |
| Family History of Diabetes | 337 | 1.96 | 0.40 - 9.58 | 0.406 |
| Waist Circumference | 337 | 1.26 | 1.14 - 1.38 | 0.000 |
| Hip Circumference | 337 | 1.30 | 1.14 - 1.47 | 0.000 |
| Eating Out | 317 | 1.09 | 0.52 - 2.30 | 0.823 |
| Blood Cholesterol | 311 | 3.18 | 1.22 - 8.33 | 0.018 |
| Blood Glucose | 337 | 0.84 | 0.36 - 1.94 | 0.684 |

In contrast to overweight, a positive though insignificant association between obesity and age was observed. Age was only associated with a 4% decreased risk of obesity (OR=0.96, 95% CI= 0.68 - 1.35), with girls having an 11% insignificant (p=0.806) increased risk for obesity (OR=1.11, 95% CI= 0.31- 4.00). This again was higher in Black learners with a 23% increased risk for obesity (OR=1.23, 95% CI=0.31 - 4.86), which was insignificant.

Physically inactive individuals had a 40% insignificantly (p=0.608) increased risk of becoming obese (OR=1.40, 95% CI=0.39 - 5.06). Spending more than 4 hours per day viewing television exposed such individuals to an insignificant (p=0.608) 9% increased risk of obesity (OR=1.09, 95% CI=0.79 - 1.51). In contrast to overweight, the residential area of the learner was not associated with obesity.

Similar to overweight, both waist and hip circumference were found to be significant risk factors for the development of obesity (p=0.0000 for both). Elevated blood cholesterol concentrations were significantly (p=0.0180) associated with obesity. Cholesterol was associated with a more than 3-fold significant increased risk for obesity (OR=3.18, 95% CI= 1.22 - 8.33).

Table 4.27b presents the results of age-adjusted risk factors for obesity using logistic regression analyses.

Table 4.27b Simple Logistic Regression Analysis for Possible Individual Risk Factors Associated with Obesity Adjusted For Age

| Risk Factor | Obs | Adjusted Prevalence Odds Ratio | 95% Confidence Interval | p-value |
|---------------------------------------|------------|--------------------------------|-------------------------|---------|
| Gender | 337 | 1.12 | 0.31 - 4.07 | 0.86 |
| Race | 335 | 1.27 | 0.32 - 5.08 | 0.739 |
| Physical Inactivity | 329 | 1.40 | 0.39 - 5.04 | 0.611 |
| Television Viewing | 337 | 1.10 | 0.79 - 1.52 | 0.579 |
| Area of Location (Belhar as Base) | 337 | 0.87 | 0.35 - 2.19 | 0.768 |
| Delft | 126 | 0.42 | 0.08 - 2.15 | 0.298 |
| Mfuleni | 51 | 1.09 | 0.20 - 5.82 | 0.923 |
| Family History of High Blood Pressure | 337 | 0.50 | 0.12 - 1.98 | 0.321 |
| Family History of Diabetes | 337 | 1.92 | 0.38 - 9.61 | 0.426 |
| Waist Circumference | 337 | 1.26 | 1.15 - 1.39 | 0.000 |
| Hip Circumference | 337 | 1.31 | 1.15 - 1.48 | 0.000 |
| Eating Out | 317 | 1.09 | 0.52 - 2.29 | 0.829 |
| Blood Cholesterol | 311 | 3.19 | 1.22 - 8.33 | 0.018 |
| Blood Glucose | 337 | 0.84 | 0.36 - 1.93 | 0.678 |

Waist circumference, hip circumference and blood cholesterol concentration were found to be the only significant risk factors associated with obesity in the adjusted model. An increase in waist circumference still exposed an individual to a 26% (p=0.000) increased risk for obesity (OR=1.26, 95% CI=1.151 - 1.39), while an increased hip circumference was associated with a 31% (p=0.000) increased risk of obesity (OR=1.31, 95% CI=1.15 - 1.48). Elevated blood cholesterol concentrations exposed learners in the study to a more than 3-fold (p=0.018) increased risk of developing obesity (OR=3.19, 95% CI=1.22 - 8.33).

Table 4.28a and Table 4.28b present the models developed for the risk factors associated with obesity, generated with the aid the advanced survey multiple logistic analysis techniques. The prevalence odds ratios for each risk factor and its associated 95% confidence interval and probability values are illustrated in these tables.

Table 4.28a Survey multiple logistic model for the prediction of obesity

Probability > F Statistic =0.0757

| Risk Factor For Obesity | Prevalence Odds Ratio | Confidence Interval | p-value |
|--------------------------------|------------------------------|----------------------------|----------------|
| Age | 0.57 | 0.34 - 0.94 | 0.027 |
| Hip Circumference | 1.31 | 1.02 - 1.68 | 0.035 |

Survey multiple logistic regression analyses, including age and hip circumference as possible risk factor for obesity, yielded an insignificant model (probability > F-statistic=0.0757). In contrast to the insignificance of the model, both the variables proved to be significant risk factors in the prediction of obesity ($p < 0.05$). Age was associated with a significant ($p=0.0270$) 43% decreased risk of obesity. An increase in hip circumference exposed individuals to a 31% increased risk of obesity (OR=1.31, 95% CI=1.02 - 1.68).

A second significant model (probability > F-statistic=0.0003) was generated with the aid of survey logistic regression techniques (Table 4.28b). Based on the results from the survey logistic analysis the risk factors associated with the aetiology of obesity included age, hip circumference and television viewing. Age and hip circumference were the only significant risk factors identified within this model ($p < 0.05$).

Table 4.28b Survey multiple logistic model for the prediction of obesity

Probability > F Statistic =0.0003

| Risk Factor For Obesity | Prevalence Odds Ratio | Confidence Interval | p-value |
|--------------------------------|------------------------------|----------------------------|----------------|
| Age | 0.57 | 0.36 - 0.89 | 0.015 |
| Hip Circumference | 1.31 | 1.05 - 1.64 | 0.019 |
| Television Viewing | 1.40 | 0.94 - 2.07 | 0.095 |

Age was associated with a 43% significant ($p=0.0150$) decreased risk of developing

obesity (OR=0.57, 95% CI=0.36 - 0.89). A positive significant association was illustrated between hip circumference and obesity ($p < 0.05$), but the relationship between television viewing and obesity proved to be insignificant ($p > 0.05$). An increase hip circumference was associated with a significant ($p=0.0190$) 31% increased risk of obesity, while spending increased amounts of time viewing television exposed individuals to an insignificant 40% increased risk of obesity (OR=1.40, 95% CI=0.94 - 2.07).

4.2.8.2 The Risk Factors for Elevated Blood Pressure (Hypertension)

Table 4.29a and Table 4.29b illustrate the risk factors associated with elevated blood pressure using simple logistic regression.

Table 4.29a Simple Logistic Regression Analysis for Possible Risk Factors Associated With Elevated Blood Pressure

| Risk Factor | Obs n= | Prevalence Odds Ratio | Confidence Interval | p-value |
|---|-----------|--------------------------|------------------------|---------|
| Age (In years) | 338 | 0.80 | 0.61 - 1.06 | 0.120 |
| Gender | 338 | 1.27 | 0.49 - 3.32 | 0.620 |
| Race | 336 | 1.02 | 0.36 - 2.93 | 0.965 |
| Physical Inactivity | 330 | 0.65 | 0.26 - 1.66 | 0.371 |
| Television Viewing | 338 | 0.86 | 0.65 - 1.14 | 0.288 |
| Area of Location (Using Belhar as Base) | 337 | 1.02 | 0.36 - 2.93 | 0.965 |
| Delft | 126 | 0.56 | 0.19 - 1.67 | 0.300 |
| Mfuleni | 51 | 0.85 | 0.23 - 3.18 | 0.812 |
| Family History of High Blood Pressure | 338 | 0.60 | 0.21 - 1.72 | 0.339 |
| Family History of Diabetes | 338 | 1.47 | 0.41 - 5.31 | 0.553 |
| Waist Circumference | 338 | 1.12 | 1.07 - 1.17 | 0.000 |
| Hip Circumference | 338 | 1.07 | 1.04 - 1.11 | 0.000 |
| Eating Out | 318 | 1.18 | 0.75 - 1.96 | 0.536 |
| Blood Cholesterol | 312 | 4.06 | 1.96 - 8.39 | 0.000 |
| Blood Glucose | 338 | 1.35 | 0.73 - 2.47 | 0.337 |
| Body Mass Index | 337 | 1.19 | 1.10 - 1.29 | 0.000 |

The significant ($p < 0.05$) risk factors associated with elevated blood pressure, were waist circumference, hip circumference, blood cholesterol concentrations and body mass index (Table 4.29a). Waist circumference was associated with a significant 12%

($p=0.000$) increased risk of elevated / high blood pressure, while an increased hip circumference resulted in a significant 7% increased risk ($p=0.000$) of having elevated blood pressure (OR=1.07, 95% CI=1.04 - 1.11).

Individuals with elevated concentrations of cholesterol were exposed to a more than 4-fold increased risk ($p=0.000$) of high blood pressure (OR=4.06, 95% CI=1.96 – 8.39.). Similarly BMI was associated with a 19% risk ($p=0.000$) of elevated blood pressure. Though gender was associated with a 27% increased risk of elevated blood pressure, this was not significant ($p=0.6200$).

Interestingly age, physical inactivity, television viewing, area of location (Delft and Mfuleni) and a family history of high blood pressure were all associated with a decreased though insignificant ($p > 0.05$) risk of elevated/high blood pressure (OR < 1.00).

Age was associated with an insignificant ($p=0.120$) 20% decreased risk of elevated blood pressure, while being physically inactive was associated with an insignificant 35% decreased risk (OR=0.65, 95% CI= 0.26 - 1.66, $p=0.371$).

Within the areas of location, residing in Mfuleni exposed learners to an insignificant 15% decreased risk of elevated blood pressure, while living in Delft was associated with a 44% decreased risk of elevated blood pressure.

Table 4.29b Simple Logistic Regression Analysis for the Risk Factors Associated with Elevated BP Adjusted For The Possible Confounding Effect of Age

| Risk Factor | Obs n= | Adjusted Prevalence Odds Ratio | Confidence Interval | p-value |
|---|-------------------|---|--------------------------------|----------------|
| Gender | 337 | 1.36 | 0.52 - 3.56 | 0.534 |
| Race | 335 | 1.15 | 0.40 - 3.33 | 0.797 |
| Physical Inactivity | 330 | 0.65 | 0.25 - 1.66 | 0.363 |
| Television Viewing | 338 | 0.88 | 0.66 - 1.16 | 0.371 |
| Area of Location (Using Belhar as Base) | 337 | 0.91 | 0.46 - 1.81 | 0.795 |
| Delft | 126 | 0.63 | 0.21 - 1.88 | 0.406 |
| Mfuleni | 51 | 1.07 | 0.28 - 4.13 | 0.925 |
| Family History of High Blood Pressure | 338 | 0.56 | 0.19 - 1.63 | 0.286 |
| Family History of Diabetes | 338 | 1.27 | 0.35 - 4.64 | 0.718 |
| Waist Circumference | 338 | 1.13 | 1.08 - 1.18 | 0.000 |
| Hip Circumference | 338 | 1.09 | 1.05 - 1.13 | 0.000 |
| Eating Out | 318 | 1.15 | 0.69 - 1.91 | 0.594 |
| Blood Cholesterol | 312 | 4.11 | 1.97 - 8.60 | 0.000 |
| Blood Glucose | 338 | 1.32 | 0.72 - 2.24 | 0.363 |
| Body Mass Index | 337 | 1.22 | 1.13 - 1.32 | 0.000 |

In parallel with the results in Table 4.29a, results obtained in the adjusted model confirmed the significant relationship of risk factors such as waist circumference, hip circumference, blood cholesterol concentration and body mass index with elevated blood pressure.

In the adjusted model in Table 4.29b, the prevalence odds ratios of gender and race both increased marginally. Thus being a female was now associated with an insignificant 36% increased risk of elevated blood pressure (OR=1.36, 95% CI=0.52 - 3.56). In contrast to the findings in the unadjusted model, living in the Mfuleni area was now associated with an insignificant (p=0.925) 7% increased risk of elevated blood pressure, compared to the insignificant (p=0.795) 37% decreased risk associated with residing in Delft in comparison to Belhar.

Survey logistic regression analyses as well as multiple logistic regression analyses techniques were employed to determine the estimated prevalence odds ratios of risk

factors associated with elevated blood pressure. These were performed in order to determine the most significant risk factors or combination of risk factors implicated in the development of elevated blood pressure levels. These odds ratios and their associated 95% confidence intervals and probability values are presented in Tables 4.30a and 4.30b.

Table 4.30a Survey multiple logistic regression model for the prediction of Elevated Blood Pressure

| Risk Factor For Obesity | Prevalence Odds Ratio | Confidence Interval | p-value |
|--------------------------------------|-----------------------|---------------------|---------|
| Hip Circumference (HC) | 1.07 | 1.03 - 1.13 | 0.003 |
| Waist-Hip Circumference Ratio (WHCR) | 5.22 | 1.63 - 16.74 | 0.006 |

Probability > F Statistic = 0.0030

Significant models for the prediction of elevated blood pressure were obtained from both the regression analyses techniques utilized (Tables 4.30a and 4.30b). The significant (p=0.003) survey logistic regression model in Table 4.30a illustrates hip circumference and waist-hip circumference ratio as the most significant risk factors, with waist-hip circumference ratio exposing learners to a more than 5-fold significant (p=0.001) increased risk of developing elevated blood pressure (OR=5.22, 95% CI=1.90 - 14.30). Hip circumference was associated with a 7% significant (p=0.000) increased risk.

Table 4.30b Multiple logistic regression model for the prediction of Elevated Blood Pressure

| Risk Factor For Elevated Blood Pressure | Prevalence Odds Ratio | Confidence Interval | p-value |
|---|-----------------------|---------------------|---------|
| Hip Circumference (HC) | 1.07 | 1.04 - 1.12 | 0.000 |
| Waist-Hip Circumference Ratio (WHCR) | 5.22 | 1.90 - 14.30 | 0.001 |

Probability > Chi2 = 0.0000

Alternative models were also generated using body mass index in conjunction with waist-hip ratio. These models also proved to be highly significant for the prediction of elevated blood pressure ($p < 0.05$) as illustrated in Table 4.31a (probability > F-statistic = 0.0021) and Table 4.31b ($p=0.0000$).

Table 4.31a Survey multiple logistic regression model for the prediction of Elevated Blood Pressure

| Risk Factor For Elevated Blood Pressure | Prevalence Odds Ratio | Confidence Interval | p-value |
|---|-----------------------|---------------------|---------|
| Body Mass Index (BMI) | 1.19 | 1.08 - 1.31 | 0.021 |
| Waist-Hip Circumference Ratio (WHCR) | 4.21 | 1.25 - 14.11 | 0.006 |

Probability > F Statistic = 0.0021

In the survey logistic regression model (Table 4.31a), body mass index was associated with a significant ($p=0.021$) 19% increased risk in the development of elevated blood pressure. Increased waist-hip circumference ratios exposed such persons to a more than 4-fold significant ($p=0.006$) increased risk of developing elevated blood pressure (OR=4.21, 95% CI=1.25 - 14.11).

Table 4.31b Multiple logistic regression model for the prediction of Elevated Blood Pressure

| Risk Factor For Elevated Blood Pressure | Prevalence Odds Ratio | Confidence Interval | p-value |
|---|-----------------------|---------------------|---------|
| Body Mass Index (BMI) | 1.19 | 1.09 - 1.29 | 0.000 |
| Waist-Hip Circumference Ratio (WHCR) | 4.21 | 1.50 - 11.77 | 0.006 |

Probability > Chi2 = 0.0000

A more significant model (Table 4.31b) was obtained with the aid of multiple logistic regression analysis ($p=0.0000$). Both the risk factors included in this model

demonstrated an increase in significance.

4.2.8.3 The Risk Factors for Elevated Blood Glucose (Glucose Intolerance)

Unadjusted and adjusted prevalence odds ratios for the respective risk factors associated with elevated blood glucose concentration and their associated 95% confidence intervals and probability values are presented in Table 4.32a and Table 4.32b.

Table 4.32a Simple Logistic Regression Analysis for Possible Risk Factors Associated with Elevated Blood Glucose Amongst Learners in Belhar, Delft and Mfuleni

| Risk Factor | Obs N= | Prevalence Odds Ratio | Confidence Interval | p-value |
|---|--------|-----------------------|---------------------|---------|
| Age (In years) | 338 | 1.11 | 0.53 - 2.32 | 0.787 |
| Gender | 338 | 0.73 | 0.05 - 11.80 | 0.826 |
| Television Viewing | 338 | 0.92 | 0.42 - 2.06 | 0.846 |
| Area of Location (Using Belhar as Base) | 338 | 1.78 | 0.29 - 10.92 | 0.531 |
| Family History of High Blood Pressure | 338 | 0.22 | 0.01 - 3.52 | 0.283 |
| Waist Circumference | 338 | 0.97 | 0.81 - 1.15 | 0.695 |
| Hip Circumference | 338 | 0.94 | 0.81 - 1.10 | 0.441 |
| Eating Out | 318 | 1.84 | 0.50 - 6.82 | 0.360 |
| Blood Cholesterol | 312 | 3.89 | 0.69 - 22.02 | 0.125 |
| Body Mass Index | 337 | 0.57 | 0.28 - 1.16 | 0.123 |

None of the risk factors (unadjusted) associated with elevated blood glucose concentrations demonstrated a significant relationship ($p > 0.05$). Age was associated with an insignificant 11% increased risk of elevated blood glucose concentrations (OR=1.11, 95% CI=0.53 - 2.32). Being female was associated with a 27% decreased risk of developing elevated blood glucose concentrations. Residing in the other areas than Belhar, was associated with an insignificant ($p=0.531$) 78% increased risk of developing elevated blood glucose levels (OR=1.78, 95% CI=0.29 - 10.92). Another

interesting finding was that increased levels of blood cholesterol exposed an individual to an almost 4-fold, though insignificant (0.125) increased risk of developing elevated blood glucose levels (OR=3.89, 95% CI=0.69 - 22.02). Poor diet was associated with an insignificant (p=0.360) 84% increased risk of developing elevated blood glucose levels (OR=1.84, 95% CI= 0.50 - 6.82).

Table 4.32b Simple Logistic Regression Analysis for Possible Risk Factors Associated with Elevated Blood glucose Amongst Learners in Belhar, Delft and Mfuleni Adjusted for Age

| Risk Factor | Obs N= | Adjusted Prevalence Odds Ratio | Confidence Interval | p-value |
|---|-----------|--------------------------------------|------------------------|---------|
| Gender | 338 | 0.71 | 0.04 - 11.53 | 0.809 |
| Television Viewing | 338 | 0.91 | 0.41 - 2.03 | 0.817 |
| Area of Location (Using Belhar as Base) | 338 | 1.73 | 0.27 - 11.13 | 0.563 |
| Family History of High Blood Pressure | 338 | 0.22 | 0.01 - 3.61 | 0.290 |
| Waist Circumference | 338 | 0.95 | 0.79 - 1.15 | 0.613 |
| Hip Circumference | 338 | 0.88 | 0.69 - 1.12 | 0.308 |
| Eating Out | 318 | 1.88 | 0.49 - 7.19 | 0.356 |
| Blood Cholesterol | 312 | 3.91 | 0.69 - 22.12 | 0.122 |
| Body Mass Index | 337 | 0.54 | 0.28 - 1.03 | 0.062 |

None of the risk factors in the adjusted model (Table 4.32b) were found to be significantly associated with elevated blood glucose concentrations.

4.2.8.4 Trend Scores for Risk Factors Associated With Overweight, Obesity and Elevated Blood Pressure.

Tests were performed to establish whether any significant trends with respect the various strata used (age, race, area of location). The results from these tests are depicted in Table 4.33.

Table 4.33 Trend Scores for Risk Factors Associated With Overweight, Obesity and Elevated Blood Pressure.

| OUTCOME | Risk Factor | | |
|-------------------------|-------------|--------|------------------|
| | Age | Race | Area of Location |
| Overweight | 0.0017 | 0.0298 | 0.0279 |
| Obese | 0.9227 | 0.7323 | 0.734 |
| Elevated Blood Pressure | 0.147 | 0.9069 | 0.553 |

As demonstrated in Table 4.33, as well as previous tables, being overweight proved to be the only categorical outcome to demonstrate a significant trend with respect to age, race and area of location.

SUMMARY

Overweight and obesity is prevalent in the learners attending school in Belhar, Delft and Mfuleni. An overall prevalence rate of overweight was observed in 12.37% of girls and 2.80% of boys, with Black girls demonstrating the highest prevalence rate of 23.08%. Statistically significant differences were observed in the prevalence rate of overweight in boys and girls, but not in obesity. Age and gender were the most significant risk factors identified for this population in the development of overweight, while obesity was significantly associated with hip circumference and age. Girls had a 5-fold risk compared to boys of being overweight. Black learners had a 2-fold risk, while learners residing in Mfuleni had a 3-fold risk of being overweight. Waist and hip circumference was associated with a 16% increased risk for overweight. Though physical inactivity was associated with a decreased risk of being overweight, this was not significant.

Elevated blood pressure was also prevalent amongst the learners in this study. Nineteen (5.62%) learners were diagnosed with elevated blood pressure, with it being

more common amongst Coloured girls (6.34%). An insignificant difference was observed in the prevalence rates of elevated blood pressure levels amongst boys and girls as well as the races. Elevated blood pressure proved to be significantly associated with obesity in the study population. Risk factors for elevated blood pressure identified for the population in this study included waist-hip circumference ratio, hip circumference, and body mass index. None of the learners were found to be diabetic.

Girls consistently demonstrated higher values for body composition and the majority of the anthropometric measurements, though all of the differences were not statistically significant. Waist circumference was higher in girls and the same pattern was observed for hip circumferences except in the age groups 14-15 years. In contrast, waist-hip circumference ratios were higher in boys in all age groups.

No statistical difference was observed in the prevalence rate of physical inactivity in overweight and obese learners with those of normal weight. No significant association of overweight and obesity with dietary patterns was found.

CHAPTER 5

DISCUSSION

5.1 Introduction

There is a worldwide awareness that obesity is increasing at an alarming rate globally. Even developing countries have not been exempted from this phenomenon. South Africa has been in a state of nutritional transition for the last decade.¹¹⁶ There has been limited data on the prevalence of overweight and obesity among learners from socio-economically disadvantaged (previously disadvantaged communities) within the Western Cape, South Africa. This is even more pertinent to children between the ages of 10-16 years. The primary objective of this study was to determine the prevalence of overweight and obesity amongst children and adolescents. The secondary objectives were to investigate a possible association between either overweight, or obesity and hypertension or diabetes, as well as to determine the risk factors associated with these respective health conditions. This study has demonstrated that obesity and, to a greater extent, overweight is prevalent amongst learners in the communities of Belhar, Delft and Mfuleni.

5.2 Prevalence of Overweight and Obesity

In the present study, an overall prevalence rate of overweight was observed in 12.37% of girls and 2.80% of boys, with Black girls exhibiting a prevalence rate of 23.08%. The prevalence of obesity was much lower with an overall prevalence rate of 2.97%. Though

girls (Black and Coloured) demonstrated significantly higher prevalence rates than the boys (Black and Coloured) both for overweight and obesity, no racial differences were observed. These results are much lower than The International Obesity Task Force (IOTF) global figures for overweight of 25% for girls and 7% for boys. There have been limited studies on the prevalence of either overweight, or obesity in previously disadvantaged children aged 10 to 15 years from South Africa. One study reported overweight prevalence rates of between 6-18% in Black children aged 0 to 10 years from South Africa.¹¹⁷ The results of the present study showed that overweight and obesity tended to increase with age. Both these findings are consistent with previous international studies.^{117,118}

Benade *et al*¹¹⁷ reported the trends of overweight and obesity in different South African population groups obtained from four major studies conducted between 1979 and 1991. They reported an increase in the prevalence of overweight and obesity with age in both boys and girls, with girls having an almost two-fold significant increase after the age of 25. Contrary to these findings Savva *et al*¹¹⁹ reported decreasing prevalence rates with age. Given the high prevalence of overweight and obesity in the South African adult population⁹, these figures call for early prevention programmes to be instituted.

Although a higher prevalence rate for overweight was observed in Black girls in particular, these data should be interpreted with caution, as Black learners constituted a relatively small proportion of the sample population. What is interesting though, is that the results also demonstrated a high prevalence in the Coloured boys relative to Black boys. Despite these issues, and given the results obtained, the observation in this study provided substantial evidence to support at a 5% level of significance the hypotheses

that there will be a gender and ethnic differential in our study population, where Blacks and girls will have higher prevalence rates of overweight.

5.3 Prevalence of Elevated Blood Pressure and Blood Glucose

The prevalence of diabetes and glucose intolerance in African communities is rapidly increasing with the ageing of the population and life-style changes associated with rapid urbanization and westernization.¹²⁰ Once considered rare in the paediatric population, the pathological processes and risk factors associated with its development have been shown to begin in childhood. Obesity has been strongly associated with abnormal glucose metabolism. In this study no learner was found to be diabetic though elevated blood glucose levels were observed in 0.59% of the sample population. Type-1-diabetes is relatively rare in Africa and much higher rates have been observed in African-American children. None of the obese or overweight children in the sample were found to be either glucose intolerant ($p>0.05$) or diabetic though they had a family history of diabetes. ($p>0.05$). Whether this may predict the future development of diabetes will need further study. Type-2-diabetes is known to be increasing in children of African origin.

Hypertension is a major cause of morbidity in many countries.¹²¹ Blood pressure level in childhood best predicts adult blood pressure level. In the Bogalusa Heart Study, tracking correlations were 0.50 for systolic and 0.45 for diastolic blood pressures over an eight-year follow-up period in childhood.

Five comma sixty-two percent (5.62%) of the learners in the present study had elevated

blood pressure (Table 4.18a). Because of the effect of pre-measurement factors such as excessive physical activity blood pressure measurements were measured using semi-automatic blood pressure monitors. Similar to the observations made in the Thusa Bana study⁴, where elevated blood pressure was more common amongst Black girls in particular, this study also demonstrated a higher prevalence of elevated blood pressure in Black girls. This may be explained by the slight selection bias towards girls found in the study population as Black girls in the sample outnumbered males by 2:1.

Blood pressure has been found to increase with an increase in obesity.⁴³ Overweight and obese children and adolescents have a two times higher risk of developing high blood pressure than children and adolescents with normal body weight.¹²² Although a significant association was observed between elevated blood pressure and obesity, no such relationship was seen among the overweight learners in the present study. These results are in contrast to the observations made in the Thusa Bana study, which reported no significant association between obesity and elevated blood pressure, though increases in both systolic and diastolic blood pressure were observed with an increase in body fat.

5.4 Physical Dimensions of Learners

Significant differences in the body mass index (BMI) between the boys and girls between the ages of 10 - 11years, which became more pronounced at or after the age of sixteen, were observed in this study. The major differences between boys and girls were encountered in body composition (Table 4.9). Girls consistently exceeded boys in terms of absolute and relative body fat. The results of this study, which showed that males

virtually demonstrated no obesity and that girls had on average a higher percentage of fat from the age 10 to 16 years, correspond with the findings from the study by Taylor *et al*¹²³ They demonstrated that girls gain more weight (predominantly due to fat accumulation) after the age of menarche. This difference may be explained in the light of physiological, metabolic and social factors. Girls tend to develop fat during adolescence due to large hormonal changes associated with menarche. An excessive development of fat at this stage, may, however, result in adverse health problems in future.¹²⁴

The circumference measurements correspond with increasing weights. Girls consistently had larger circumference measurements compared to males. Increases in circumferences generally reflect increases in muscle and fat weight, which are major contributors to weight. As girls had significantly higher percentages for body fat, it was expected that girls would present with higher circumference measurement values than boys. A highly significant correlation was observed between body mass index and waist or hip circumferences, which was independent of age. These two simple measurements can therefore be used as an indicator for overweight or obesity in this population.

5.5 Risk Factors for Overweight and Obesity

Various factors were identified as being significant contributors to the development of overweight, obesity, elevated blood pressure and elevated blood glucose concentrations. These factors included:

5.5.1 Dietary Factors

South Africa is undergoing a process of rapid urbanization characterized by a nutrition

transition.¹²⁵ In most countries affected by this process, the nutrition of children is increasingly becoming a concern as evidence suggest that childhood nutrition also influences future adult health.¹²⁶ Many households and communities in South Africa have shown an increase in the incidence of non-communicable diseases due to improper diets, with obesity being one of the most important nutritional diseases.¹²⁷

A qualitative assessment of the foods consumed did not reveal a significant difference between the eating patterns of either overweight or obese learners with learners of normal weight, though in general, the former group consumed more unhealthy foods. This lack of association was also observed in learners who repeatedly ate fast foods more frequently. Similar to the study by Ramachandran *et al*¹²⁸ in Indian adolescent school children, the lack of association observed in the present study could be attributed to the underreporting by subjects. Sample size may also have influenced the results obtained. The insignificant association of recognized food items associated with overweight and obesity is in direct contrast to the findings in the study by Nicklas *et al*¹²⁹, on the dietary patterns of 10-year-olds in the Bogalusa Heart Study. Findings from their study revealed a positive association of dietary patterns (decreased intake of fruit and vegetables, and the increased consumption of soft drinks, sweets, and other high-carbohydrate containing snacks) with overweight.

5.5.2 Physical Inactivity

Increased physical activity has been proven to be successful in the prevention and non-pharmacological treatment of obesity. Physical activity also contributed to a loss in body weight, which in turn leads to significant lowering of blood pressure.¹³⁰ In this study, physical inactivity was not significantly associated with either overweight or obesity.

These results are similar to those reported in the Thusa Bana Study in which the association between physical activity and body fat distribution was examined in 1245 South African children (different ethnic groups) between the ages of 10-15 years. However, a survey conducted on transitional African communities in the North-West Province of South Africa demonstrated that inactivity, independently of the degree of urbanization, was associated with increasing obesity levels in adults.¹³¹ Similarly the lack of association between physical inactivity and blood pressure in the study has also been reported in children who participated in the Thusa Bana study. However one reason for the lack of association could be due to the presence of confounding factors, which cannot be accounted for. Evidence from the study by O'Loughlin *et al*¹³² in schoolchildren in Canada found that physical inactivity was not related to overweight. These findings are in contrast to the findings documented in available literature. As well as being a well-recognized risk factor for the aetiology of overweight and obesity, various previous international studies have demonstrated the significant relationship of physical inactivity and overweight and obesity.^{133,134, 135}

In general, more males were found to take part in sport activities. This is encouraging as physical activity is an important component of healthy lifestyle. Whether this is a result of the recent initiative of the South African government to promote physical activity in previously disadvantaged communities was not studied. However female learners need to be encouraged to participate more often in sporting activities. Lambert *et al*¹³⁶ noted that the majority of South Africans studied in various regional cross-sectional surveys reported low-to-moderate levels of participation in physical activity.

According to Hancox *et al*¹³⁷, children in developing countries spend a lot of time on

television viewing. Parallel to this, a tendency for spending more time on television viewing is also increasingly observed amongst South African youth.³¹

In the present study no significant relationship between television viewing and either overweight or obesity was observed. In contrast to these results, a study on Mexican children found that the odds ratio of obesity increased significantly by 12% for each hour of television program viewing per day.¹³⁸ However, television viewing was found to be a risk factor along with hip circumference and age in the multiple logistic regression models generated for the prediction of obesity ($p < 0.05$).

5.5.3 Gender

One of the most important risk factors for overweight in this study was gender. In all the models generated (Table 4.26a and 4.26b), gender was shown to be a significant risk factor for the development of overweight. Girls had an almost 5-fold significantly increased risk of becoming overweight, but interestingly this was not the case for obesity.

Other risk factors associated with an increased risk of overweight and obesity included age, race, and area of location and waist circumference. Individually all of these variables showed a significant relationship with overweight and obesity, but lost their significance when corrected for age. The relationship of gender with overweight could probably also be explained by the onset of puberty and its associated increase in hormones.

5.5.4 Socio-economic Factors

Classification of learners into social class was hampered by the slight representivity problems encountered and insufficient data obtained resulting from the data collection tool. All the socio-economic indicators employed in this study proved to be insignificantly related to overweight and obesity.

LIMITATIONS OF THIS STUDY

The possible limitations underlying this study includes the following:

- ❖ Venous blood is the preferred sample for the accurate measurement of glucose, cholesterol, triglycerides and other constituents in the body. Although less invasive methods are widely accepted and employed, the accuracy of the assessment and the classification of diabetes could have been adversely affected in this study. The drawing of blood in this study raised quite a lot of ethical dilemmas and it was for this reason that venous blood was not drawn from all participants in this study. Instead capillary blood obtained with the aid of a finger prick was felt to be appropriate provided all measures were undertaken to ensure good quality control.
- ❖ Some learners could have crossed geographical boundaries and may not necessarily have come from the location used in this study.
- ❖ Because of the broad age groups selected, the onset of puberty and sexual maturation within these groups could have affected some of the

parameters, making it difficult to generate totally accurate inferences.

- ❖ Another limitation of this study is the cross-sectional study design. Although attempts have been made to design the study in such a manner as to ensure proper inferences to the general population, representivity problems could still have been encountered which could possibly influence the validity and reliability of the present results.
- ❖ The structure of both the physical activity and the food consumption frequency questionnaire was a major limitation to the study. Methods used to obtain quantitative data (for example calorie intake), are time consuming. Due to this and the limited time available to access learners (as well as the interference in the academic programmes these methods would cause), semi-quantitative and qualitative approaches were chosen.
- ❖ The role of parental obesity could not be explored as it was felt that learners might not be able to provide accurate information. Similarly, socio-economic status based on a family income could not be determined. As such indirect measures of socio-economic status were used, which may not be totally accurate.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

Overweight and obesity is prevalent in the learners attending school in Belhar, Delft and Mfuleni. An overall prevalence rate of overweight was observed in 12.37% of girls and 2.80% of boys, with Black girls demonstrating the highest prevalence rate of 23.08%. Statistically significant differences were observed in the prevalence rate of overweight in boys and girls, but not in obesity. Though moderate, overweight and obesity is prevalent in our study population, and the global increasing trend of these conditions might also result in an increase in the current rate in coming years. Literature has provided sufficient evidence for associations between overweight and obesity in children and adolescents and several potentially contributing factors. Age and gender were the most significant risk factors identified for this population in the aetiology of overweight, while obesity was significantly associated with hip circumference and age.

Elevated blood pressure was also prevalent amongst the learners in this study. Nineteen (5.62%) learners were diagnosed with elevated blood pressure, with it being more common amongst Coloured girls (6.34%). An insignificant difference was observed in the prevalence rates of elevated blood pressure levels amongst boys and girls as well as the races. Elevated blood pressure proved to be significantly associated with obesity in the study population, but not with overweight. Risk factors for elevated blood pressure identified for the population in this study included waist-hip circumference ratio, hip circumference, and body mass index. As elevated blood pressure is a known determinant for hypertension, the need for early detection and treatment cannot be over-

emphasised. None of the learners were found to be diabetic.

It was observed that a large proportion of the sample was physically inactive. No statistical difference was observed in the prevalence rate of physical activity in overweight and obese learners with those of normal weight. Although this study has not illustrated physical inactivity to be a significant risk factor in the aetiology of overweight and obesity, the relationship of physical inactivity is well known and thus requires further investigation in the sample population. No significant association was seen of overweight and obesity with dietary patterns.

Visit at school tuck shops during fieldwork, revealed an increased availability in food items such as hot potato chips, gatsby's, pies, and soft drinks; all foods that are, according to literature, implicated in the development of overweight and obesity. In the light of the above conclusions drawn from this investigation, the following recommendations should be considered favourably:

- 1 Compulsory physical education programmes should be re-instated at schools, as well as the rule of compulsory participation in at least two sport codes.
- 2 Health educational programmes should be part of all standard syllabi in schools. These programmes should be designed to provide learners with adequate information to be able to make better informed and healthy food and behaviour choices.
- 3 Adequate prevention programmes should be developed, implemented and

monitored on a regular basis.

- 4 Routine or periodic screening within the school system is also recommended.

AREAS FOR FURTHER EXPLORATION:

- 1 The establishment of a general background population prevalence of type-2-diabetes and hypertension amongst children in previously disadvantaged communities.
- 2 Further studies are needed to examine the dietary and physical activity patterns associated with the development of overweight and obesity amongst children in the identified disadvantaged communities.
- 3 The development of adequate local reference data for overweight and obesity applicable to children in the abovementioned areas.
- 4 Follow-up studies need to be conducted in order to track the development of overweight and obesity in the current study population.

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Navrae
Enquiries Dr Ronald Cornelissen
IMibuzo
Telefoon
Telephone (021) 467-2286
IFoni
Faks
Fax (021) 425-7445
IFekai
Verwysing
Reference 20030806-0027
ISalathiso



Wes-Kaap Onderwysdepartement

Western Cape Education Department

ISEBE leMfundo leNtshona Koloni

Ms Avril Somers
H207 Heroes House
P.O. Box 1906
Peninsula Technikon
BELLVILLE
7535

RESEARCH PROPOSAL: OBESITY AMONGST LEARNERS ATTENDING SCHOOLS IN BELHAR, DELFT AND MFULENI.

Your application to conduct the above-mentioned research in schools in the Western Cape has been approved subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Educators' programmes are not to be interrupted.
5. The Study is to be conducted from **3rd February 2004 to 31st March 2004.**
6. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December 2003).
7. Should you wish to extend the period of your survey at the school(s), please contact Dr R. Cornelissen at the contact numbers above quoting the reference number.
8. A photocopy of this letter is submitted to the principal of the school where the intended research is to be conducted.
9. Your research will be limited to the list of Schools as submitted to the Western Cape Education Department (see attachment for the list).
10. A brief summary of the content, findings and recommendations is provided to the Director: Education Research.
11. The Department receives a copy of the completed report/dissertation/thesis addressed to:
**The Director: Education Research
Western Cape Education Department
Private Bag 9114
CAPE TOWN
8000**

We wish you success in your research.

Kind regards.

Signed: Ronald S. Cornelissen
for: **HEAD: EDUCATION**

DATE: 13 August 2003

List of Schools:

Belhar (Primary Schools)

Accordianstraat Primary
Belhar Primary
Belvue Primary
Dr Van Der Ross
Erica Primary
Gardenia Primary
Matroosbergweg Primary
Riebeeckstraat Primary
Symphony Primary

Belhar (Secondary Schools)

Belhar Secondary
Excelsior Secondary
Perseverance Secondary
Symphony Secondary

Delft (Primary Schools)

Eindhoven Primary
Sunray Primary
Rosendal Primary
The Hague Primary
Vergenoeg Primary
Delft South Primary
Delft South No. 3 Primary
Delft Primary

Delft (Secondary Schools)

Simunye Secondary
Masibambisane Secondary
Rosendaal Secondary
Voorbrug Secondary

Mfuleni (Primary Schools)

Mfuleni Primary

Mfuleni (Secondary Schools)

Manzomthombo Secondary

HEAD: EDUCATION

DATE:

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R |
|----|---|-------------------|-------------|-----------|----------------|-----------|---------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|---|------------|------------|
| 1 | Annex 2 | | | | | | | | | | | | | | | | | |
| 2 | LIST OF SCHOOLS IN THE BELHAR, DELFT AND MFULENI AREAS - PRIMARY SCHOOLS | | | | | | | | | | | | | | | | | |
| 3 | BELHAR | | | | | | | | | | | | | | | | | |
| 4 | No. | Name of School | Cl p. Grade | | Total p. Grade | | Total p. Sch. | | | | | | | | | | | |
| 5 | | | Gr. 4 | Gr. 5 | Gr. 6 | Gr. 7 | Gr. 4 | Gr. 5 | Gr. 6 | Gr. 7 | | | | | | | | |
| 6 | 1 | Accordianstraat | 2 | 3 | 4 | 4 | 99 | 5 | 140 | 6 | 156 | 7 | 156 | 7 | 551 | | 25 | 25 |
| 7 | 2 | Belhar | 4 | 4 | 4 | 4 | 104 | 5 | 162 | 7 | 162 | 7 | 158 | 7 | 586 | | 26 | 26 |
| 8 | 3 | Belvue | 2 | 3 | 4 | 3 | 71 | 3 | 95 | 5 | 143 | 7 | 133 | 6 | 442 | | 21 | 20 |
| 9 | 4 | Dr. Van Der Ross | 4 | 4 | 4 | 4 | 103 | 5 | 108 | 5 | 187 | 9 | 134 | 6 | 532 | | 25 | 24 |
| 10 | 5 | Erica | 2 | 3 | 3 | 3 | 72 | 3 | 106 | 5 | 128 | 6 | 122 | 5 | 428 | | 19 | 19 |
| 11 | 6 | Gardenia | 1 | 2 | 2 | 2 | 34 | 2 | 74 | 3 | 87 | 4 | 57 | 3 | 252 | | 12 | 11 |
| 12 | 7 | Matroosbergweg | 1 | 2 | 2 | 2 | 45 | 2 | 56 | 3 | 100 | 5 | 56 | 3 | 257 | | 13 | 12 |
| 13 | 8 | Riebeeckstraat | 3 | 4 | 4 | 3 | 116 | 6 | 156 | 7 | 190 | 9 | 142 | 6 | 604 | | 28 | 27 |
| 14 | 9 | Symphony | 3 | 3 | 3 | 3 | 94 | 4 | 113 | 5 | 133 | 6 | 131 | 6 | 471 | | 21 | 21 |
| 15 | | TOTAL | 22 | 28 | 30 | 28 | 738 | 35 | 1010 | 46 | 1286 | 60 | 1089 | 49 | 4123 | | 190 | 185 |
| 17 | DELFT | | | | | | | | | | | | | | | | | |
| 18 | No. | Name of School | Cl p. Grade | | Total p. Grade | | Total p. Sch. | | | | | | | | | | | |
| 19 | | | Gr. 4 | Gr. 5 | Gr. 6 | Gr. 7 | Gr. 4 | Gr. 5 | Gr. 6 | Gr. 7 | | | | | | | | |
| 20 | 1 | Eindhoven | 3 | 4 | 5 | 4 | 140 | 7 | 212 | 10 | 253 | 11 | 175 | 8 | 780 | | 36 | 35 |
| 21 | 2 | Sunray | 4 | 4 | 6 | 4 | 163 | 7 | 186 | 9 | 276 | 13 | 184 | 8 | 809 | | 37 | 36 |
| 22 | 3 | Rosendal | 4 | 3 | 5 | 5 | 160 | 7 | 150 | 7 | 250 | 12 | 215 | 10 | 775 | | 36 | 35 |
| 23 | 4 | The Hague | 3 | 4 | 5 | 4 | 119 | 6 | 178 | 8 | 256 | 12 | 193 | 8 | 746 | | 34 | 34 |
| 24 | 5 | Vergenoeg | 3 | 5 | 6 | 5 | 121 | 6 | 229 | 10 | 276 | 12 | 201 | 9 | 827 | | 37 | 37 |
| 25 | 6 | Delft South | 4 | 4 | 5 | 4 | 169 | 8 | 167 | 8 | 236 | 11 | 171 | 7 | 743 | | 34 | 34 |
| 26 | 7 | Delft South No. 3 | 4 | 4 | 4 | 4 | 193 | 8 | 218 | 10 | 210 | 10 | 175 | 8 | 796 | | 36 | 36 |
| 27 | 8 | Delft Primary | 3 | 4 | 4 | 4 | 162 | 8 | 274 | 12 | 277 | 12 | 241 | 11 | 954 | | 43 | 43 |
| 28 | | TOTAL | 28 | 32 | 40 | 34 | 1227 | 57 | 1614 | 74 | 2034 | 93 | 1555 | 69 | 6430 | | 293 | 290 |
| 30 | MFULENI | | | | | | | | | | | | | | | | | |
| 31 | No. | Name of School | p. Grade | | Total p. Grade | | Total p. Sch. | | | | | | | | | | | |
| 32 | | | Gr. 4 | Gr. 5 | Gr. 6 | Gr. 7 | Gr. 4 | Gr. 5 | Gr. 6 | Gr. 7 | | | | | | | | |
| 33 | 1 | Mfuleni | 4 | 4 | 4 | 4 | 190 | 9 | 200 | 9 | 186 | 8 | 164 | 7 | 740 | | 33 | 33 |
| 34 | | TOTAL | 4 | 4 | 4 | 4 | 190 | 9 | 200 | 9 | 186 | 8 | 164 | 7 | 740 | | 33 | 33 |
| 36 | Total Classes | | 54 | 64 | 74 | 66 | | | | | | | | | | | | |
| 37 | | | | | | | | | | | | | | | | | | |
| 38 | GRAND TOTAL-Learners in Primary Schools | | | | | | 2155 | 2824 | 3506 | 2808 | | | | | | | | |
| 39 | | | | | | | | | | | | | | | | | | |
| 40 | | | | | | | | | | | | | | | | | | |

INFORMATION AND INFORMED CONSENT DOCUMENT

TITLE OF THE RESEARCH PROJECT:

Weight Gain amongst learners attending schools in Belhar, Delft and Mfuleni.

REFERENCE NUMBER:

PRINCIPAL INVESTIGATOR: AVRIL SOMERS

ADDRESS: DEPARTMENT OF HEALTH SCIENCES
FACULTY OF SCIENCE
PENINSULA TECHNIKON, BELLVILLE

DECLARATION BY PARTICIPANT:

I, THE UNDERSIGNED, (name)

of.....

.....(address).

A. HEREBY CONFIRM AS FOLLOWS:

1. I was invited to participate in the abovementioned research project, which is being undertaken by the Department of Health Sciences, Faculty of Science at Peninsula Technikon.

2. The following aspects have been explained to me / the participant:

2.1 **Aim:** The Peninsula Technikon, in collaboration with the Medical Research Council and University of Stellenbosch is conducting this important study to assess the impact of obesity amongst learners attending school in Belhar, Delft and Mfuleni.

2.2 **Procedures:** I shall be required to provide information (in the form of three questionnaires) on my family health-related history, lifestyle and behavioural habits, eating and drinking habits, as well

*Delete where not applicable

as my usual physical and leisure activities. Height, weight and circumference measurements, as well as skin fold measurements will be taken. This is done in order to determine my body composition or body weight. Blood will be taken in a finger prick test, where the side of my finger is punctured to allow the formation of a single drop of blood. Tests that will be carried out on my blood will measure the amount of glucose, cholesterol and triglycerides in my body. I shall also be asked to take a sample of my urine. A urinalysis will be performed on this urine using a commercial test kit.

2.3 Risks:

From the finger prick test

I shall feel a single sharp prick. Slight bruising may occur, but this is minor and will heal quickly.

From the Anthropometric Measurements

Besides the possibility of being asked to undress modestly, there are no risks attached to these measurements.

From the Blood Glucose Concentration Test

A trained professional, to ensure that correct procedures are followed and no unnecessary harm is done, will only draw blood. Slight bruising might thus occur, but this will heal quickly.

2.4 Possible benefits: These tests will help to determine whether I am at risk of becoming obese and of developing any of the associated problems.

What the researcher learn from this study will help to protect me and other children in the community and South Africa at large.

They will learn how best to prevent the incidence of obesity and obesity-related conditions.

2.5 Confidentiality: The records of all tests and results will be kept fully confidential and will be made available to me. Some results may be published in a Medical Journal to let people know of the research findings. My identity will never be disclosed.

2.6 Access to findings: I shall have access to all the results at any time and there are no special conditions attached.

2.7 Voluntary participation / refusal / discontinuation:

My participation in this project is voluntary and I can withdraw from it at any time without any penalization.

3. The information above was explained to me by
..... (*name of relevant person*) in
Afrikaans/*English/*Xhosa/*Other and I
am in command of this language/*it was satisfactorily translated to me
by (*name of translator*). I was given the
opportunity to ask questions and all these questions were answered
satisfactorily.

4. No pressure was exerted on me to consent to participation and I understand that I may withdraw at any stage without any penalty.

5. Participation in this study will not result in any additional costs to myself.

*Delete where not applicable

B. HEREBY CONSENT VOLUNTARILY TO PARTICIPATE IN THE ABOVE-MENTIONED PROJECT/*THAT THE POTENTIAL PARTICIPANT MAY PARTICIPATE IN THE ABOVEMENTIONED STUDY.

Signed/confirmed at.....on20

(place)

(date)

.....
Signature or right thumb print of the participant

.....
Signature of witness

STATEMENT BY THE PARENT/ LEGAL GUARDIAN/ PRIMARY CARETAKER:

I, THE UNDERSIGNED,..... (name)

[ID No:] in my capacity as.....

of the participant [Reference Code.....] of.....

..... (address).

Declare that

- The information given in this document was satisfactorily explained to both me..... (name of the parent/guardian) and the participant..... (name of the participant);
- The investigator encouraged and give me ample time to ask any questions;
- this conversation was conducted in Afrikaans/ *English/ *Xhosa/ *Otherand no translator was used/*this conversation was translated into(language) by (name

Signed aton20

(place)

(date)

.....
Signature of investigator/*investigator's representative

.....
Signature of witness

STATEMENT BY OR ON BEHALF OF INVESTIGATOR(S):

I,,
declare that

- I explained the information given in this document to
.....(name of the participant) and/*or his/*her
representative(name of representative);
- he/*she was encouraged and given ample time to ask me any questions;
- this conversation was conducted in Afrikaans/ *English/ *Xhosa/ *Other
.....and no translator was used/*this conversation
was translated into(language) by
..... (name).

Signed at on20
(place) (date)

.....
Signature of investigator/*investigator's representative Signature of witness

DECLARATION BY TRANSLATOR:

I,(name),
confirm that I

- translated the contents of this document from English into
..... (indicate the relevant language) to the participant and/or his
/*her representative (parent or legal guardian);
- explained the contents of this document to the participant/*the participant's
representative;

*Delete where not applicable

- also translated the questions posed by(name) as well as the answers given by the investigator/*the investigator's representative; and
- conveyed a factually correct version of what was related to me.

Signed at on20

(place)

(date)

.....
Signature of translator

.....
Signature of witness

IMPORTANT MESSAGE TO THE PARTICIPANT/ REPRESENTATIVE OF THE PARTICIPANT:

Dear Participant/ representative (parent or legal guardian of the participant)

Thank you for your or your child's participation in this study. Should, at any time during the study,

- an emergency arise as a result of the research, or
- you require any further information with regard to the study, or
- the following occur:

Excessive inflammation at site of puncture (finger prick and venous blood collection), kindly contact:

Ms Avril Somers at telephone number (021) 959 6274 or 083 360 9284

Mr Emmanuel Rusford at telephone number (021) 959 6366 or 082 202 0799

Mr Shafick Hassan at telephone number (021) 959 6274

Professor RT Erasmus at telephone number 021 9384107 or 084 553 0912

INFORMASIE EN INGELIGTE TOESTEMMING DOKUMENT

TITEL VAN DIE NAVORSINGS PROJEK:

Verhoging in Liggaams Massa Onder Leerders wat Skole in die Gemeenskappe van Belhar, Delft and Mfuleni bywoon.

VERWYSINGS NOMMER:

HOOF ONDERSOEKER: AVRIL SOMERS
ADRES: DEPARTMENT VAN GESONDHEIDS
WETENSKAPPE
WETENSKAPS FAKULTEIT
PENINSULA TECHNIKON, BELLVILLE

VERKLARING VAN DEELNEMER:

EK, DIE ONDERTEKENDE (naam)

van

.....(adres).

A. HIERMEE BEVESTIG DAT:

1. Ek genooi was om deel te hê in die bogenoemde navorsingsprojek, wat deur die Departement van Gesondheids Wetenskappe, by die Fakulteit van Wetenskap aan die Peninsula Technikon onderneem word.

2. Die volgende aspekte was aan my verduidelik:

2.1 Doel: Die Peninsula Technikon en die Universiteit van Stellenbosch doen hierdie belangrike study om die impak van gewigs optel onder kinders (in hierdie geval, leerders wat skool bywoon) to evalueer.

2.2 Prosedures: Ek sal gevra word om informasie (in die vorm van 'n vraelys) van my familieële gesondheids-verwante geskiedenis, my leefwyse en gedragsgewoontes, sowel as my gewoonlike fisiese en ontspannings aktiwiteite te voorsien. My lengte, gewig, liggaams omtrekke, asook my velvou mate sal gemeet word. Dit sal gedoen word om my liggaams samestelling of liggaams gewig te bepaal. Bloed sal van my geneem word in 'n vingerprik toets, waar die kant van my vinger geprik sal word om 'n engele druppel bloed te laat vorm. Toetse wat die hoeveelheid glukose (bloedsuiker), cholesterol en triglyseriene in my liggaam meet, sal op hierdie bloed uitgevoer word. Ek sal ook gevra word om 'n urine monster te voorsien. Analise op die urine monster sal uitgevoer word met behulp van 'n kommersiële toets stel.

2.3 Risikos:

Van die Vingerprik Toets

Ek sal 'n skerp prik voel. Effense kneusing mag voorkom, maar is gering en sal gou genees.

Van die Antropometriese Meetings

Behalwe die moontlikheid dat ek gevra kan word om modestly te ontklee, is daar geen risikos verbonde aan hierdie meetinge nie.

Van die Bloed Glukose Toets

Om te verseker dat alle procedures korrek gevolg word en dat geen onnodige skade gedoen word nie, sal bloed slegs deur 'n ten volle gekwalifiseerde professioneel getrek word. Effense kneusing mag voorkom, maar is gering en sal gou genees.

2.4 Moontlike Baat: Hierdie toetse sal dit moontlik maak om te bepaal of ek die risiko loop om oobes te word en al die geassosieerde probleme te ontwikkel.

Wat ons uit hierdie studie leer sal help om u, en ander kinders in die gemeenskap en Suid Afrika as 'n geheel, te beskerm. Ons sal ook leer hoe om die voorkoms van obesiteit en obesiteitsverwante toestande ten beste te voorkom.

2.5 Vertroulikheid: Alle records van toetse en hul resultate sal ten volle vertroulik bly en aan u beskikbaar gemaak word. Sommige van die resultate mag in 'n Mediese Joernaal gepubliseer word om mense omtrent ons navorsings bevindinge in te lig. U identiteit sal nooit verklap word nie.

2.6 Toegang tot bevindings: U sal enige tyd toegang tot alle bevindinge hê en geen spesiale omstandighede sal daaraan geheg word nie.

2.7 Vrywillige deelname/ weiering/ diskontinuasie: My deelname aan hierdie projek is heeltemaal vrywilliglik en ek kan my op enige tydstop onttrek sonder enige boete.

3. Die informasie was aan my verduidelik deur.....(*naam van relevante persoon*) in Afrikaans/*Engels/*Xhosa/*Ander..... en ek is hierdie taal ten volle magtig/*Dit was bevredigend aan my vertaal deur (*naam of tolk*). Ek was die kans gegun om vrae te vra, en al hierdie vrae was bevredigend beantwoord.
4. Geen druk was op my uitgeoefen om my toestemming om deelname te verleen nie, en ek verstaan dat ek my mag onttrek op enige tydstop, sonder enige boete.

* Wis uit wat nie van toepassing is nie
myself.

study will not result in any additional costs to

B. HEERMEE GEE EK VRYWILLIGE TOESTEMMING OM AAN DIE BOGENOEMDE PROJEK DEEL TE NEEM/ DAT DIE POTENSIELE DEELNEMER AAN DIE BOGENOEMDE STUDIE MAG DEEL NEEM.

Geteken/bevestig te.....op.....20

(plek)

(datum)

.....
Handtekening of regterduim afdruk
van deelnemer

.....
Handtekening van Getuie

VERKLING DEUR OUER/ WETTIGE VOOG/ PRIMERE VERSORGER:

EK, DIE ONDERTEKENDE,..... (naam)

[ID No:] in my kapasiteit as

..... van die deelnemer [Identity Code

van.....

.....(adres).

Verklaar dat

- Die informasie in hierdie document bevredigend aan beide my
..... (naam van ouer/ voog) en die
deelnemer (naam van deelnemer);
- Die ondersoeker het my aangemoedig en ruim tyd gegee om enige vrae to
stel;
- hierdie gesprek was gevoer in Afrikaans/ *Engels/ *Xhosa/ *Ander
.....en geen tolk was gebruik nie/*hierdie gesprek
was vertaal na(taal)

deur.....

(naam)

Geteken te..... op20

(plek)

(datum)

.....
Handtekening of regterduim afdruk
van deelnemer

.....
Handtekening van Getuie

VERKLARING DEUR ONDERSOEKER/NAMENS DIE ONDERSOEKERS):

Ek,

verklaar dat

- Ek al die inligting in hierdie document verskaf aan
.....(naam van
deelnemer) en/*of sy/*haar verteenwoordiger
.....(naam van verteenwoordiger);
- hy/*sy was aangemoedig en ruim tyd gegee om vrae aan my te stel;
- hierdie gesprek was gevoer in Afrikaans/ *Engels/ *Xhosa/ *Ander
..... en geen tolk was gebruik nie/ *hierdie gesprek
was vertaal na(taal) deur
..... (naam).

Geteken te on20

(plek)

(datum)

.....
Handtekening van ondersoeker / verteenwoordiger
van Ondersoeker

.....
Handtekening van Getuie

VERKLARING DEUR TOLK:

Ek,(name),
bevestig dat ek

- die volle inhoud van hierdie document vanaf Engels na(taal) aan die deelnemer en / of sy / haar verteenwoordiger (ouer of wettige voog) vertaal het.
- Die inhoud van hierdie document aan die deelnemer / *die deelnemer verduidelik het;
- Ook die vrae deur(naam) gestel, so wel as die antwoorde gegee deur die navorser / die verteenwoordiger van die navorser vertaal het; en
- 'n feitelik korrekte weergawe van wat my meegedeel was oorgedra het.

Geteken te op20

(plek)

(datum)

.....
Handtekening van tolk

.....
Hantekening van Getuie

* Wis uit wat nie van toepassing is nie

**BELANGRIKE BOODSKAP AAN DIE DEELNEMER / VERTEENWOORDIGER
VAN DIE DEELNEMER :**

Geagte Deelnemer / Verteenwoordiger van die Deelnemer (Ouer of Wettige Voog van die deelnemer)

Dankie vir u of u kind se deelname aan hierdie projek. Indien daar op enige stadium gedurende die studie,

- 'n noodgeval voorkom as gevolg van hierdie navorsing, of
- u enige verdere inligting omtrent hierdie studie verlang, of
- die volgende voorkom:
Uitermate inflammasie by die plek van die prik (vinger prik en bloed insameling), kontak vir:

Me Avril Somers by telefoon nommer (021) 959 6274 of 083 360 9284

Mr Emanuel Rusford by telefoon nommer (021) 959 6336

Mr Shafick Hassan by telefoon nommer (021) 959 6274

Professor RT Erasmus by telefoon nommer 021 9384107 of 084 553 0912

PENINSULA TECHNIKON
CHILDHOOD OBESITY QUESTIONNAIRE
FAMILY HEALTH-RELATED AND BEHAVIOURAL HISTORY



Principal Interviewer: Avril Somers

Name of Interviewer:

Date of interview:
y y m m d d

Reference Number:

1

To the Respondent:

Thank you very much for the willingness to participate in the completion of this questionnaire.

Most chronic diseases develop slowly in the presence of certain risk factors. This questionnaire has been developed to provide us with relevant information about your health, life-style and family's health history. The information obtained will be used to identify your personal risks of developing certain conditions related to particular risk factors. The questionnaire should not take too long and we hope you will find it interesting and enjoyable. The information provided with this questionnaire, will be treated as confidential and anonymous.

Completing the Questionnaire:

I would now like to start administering the questionnaire. Please feel free to ask for further assistance if any of the questions are not clearly understood. No special knowledge is required to complete this questionnaire.

Physical Address: _____

Residential Address: _____

Telephone or Cellphone Number: (021) _____ (0) _____

*For Official
Use Only*

School attended:

2

Primary or Secondary School?

P
 S

3

PERSONAL DATA

Instructions:

Please complete the following general information about yourself by ticking the appropriate answer. Please, take your time and read each question carefully.

- 1 **What is your date of birth?** y y m m d d
 4
- 2 **What is your gender?**
a) Male 1 5
b) Female 2
- 3 **In which Grade are you?**
a) 4th 0 b) 5th 1 c) 6th 2 d) 7th 3 6
e) 8th 4 f) 9th 5 g) 10th 6
- 4 **How long have you been attending this school?**
a) Less than 6 months 1 b) Less than one year 2 7
c) 1 - 5 years 3 d) 6 - 10 4
- 5 **How would you describe yourself? (select one response)**
a) Black 1 b) White 2 8
c) Coloured 3 d) Asian 4
- 6 **Where do you live?**
a) Belhar 1 b) Delft 2 c) Mfuleni 3 d) Other 4 9
- 7 **How long have you been living at your current address?**
a) Less than 6 months 0 b) Less than one year 1 10
c) 1 - 5 years 2 d) 6 - 10 3
- 8 **How many people are living in your house (including your mother and father)?** 11
- 9 **How many siblings (brothers and sisters) do you have?** 12

FAMILY HEALTH HISTORY

Instruction:

The following questions will tell us about your family health history.

Please complete all the questions by placing a cross (x) over the box of your choice or writing in the appropriate answer.

- 10 Have you ever been told that you have Diabetes? 13
a) Yes 1
b) No 2
- 11 Does your natural mother, father, sister or brother have Diabetes? 14
a) Yes 1
b) No 2
- 12 Has anyone in your extended family (Aunts, Uncles, Grandfather or Grandmother) ever suffered from Diabetes? 15
a) Yes 1
b) No 2
- 13 If Yes, state who and whether that person is family on your mother's side or on your father's side. (Mother/Father's sister, cousin, brother) 16
a)
b)
c)
- 14 Did either of your natural parents die of a heart attack before the age of 60? (if your parents are younger than 60, mark No) 17
a) Yes, one of them 1 b) Yes, both of them 2
c) No 3 d) Not sure 4
- 15 Have you ever been told that you suffer from, and/or treated by a doctor for: 18
Heart Problems
a) Yes 1
b) No 2
- Angina** 19
a) Yes 1
b) No 2
- Painful Joints** 20
a) Yes 1
b) No 2

- 16 Are you taking medicine for high blood pressure?
 a) Yes 1
 b) No 2 21
- 17 Does your natural mother, father, sister or brother have high blood pressure?
 a) Yes 1
 b) No 2 22
- 18 Select the answer that describes your blood pressure:
 a) High 1 b) Normal 3 23
 c) Low 2 d) Don't know 4
- 19 At which age did you have your first menstrual period? 24

LIFESTYLE

Instructions:

Please complete the following questions about your lifestyle and health behaviour by placing a cross (X) over the box of your choice.

Smoking and Alcohol Consumption

- 19 Do you smoke?
 a) Yes 1
 b) No 2 25
- 20 How many cigarettes do you usually smoke per day?
 a) I don't smoke 0 26
 b) I smoke cigarettes per day
- 21 Do you consume any alcoholic beverages?
 a) Yes 1
 b) No 2 27
- 22 When you drink alcoholic beverages, how many drinks (glasses) do you consume in an average day? (if you never drink alcoholic beverages, tick 0)
 a) 0 0 28
 b) I drink glasses per day

- 23 On the average, how many days per week do you consume alcohol?
- a) 1 b) 2 c) 3
- d) 4 e) 5 f) 6
- g) 7 h) 0
- 29

Physical Activity

- 24 On a typical day how do you USUALLY travel? (Check only one)
- a) Walk b) Bicycle c) Motorcycle
- d) Car e) Truck or Van f) Bus
- g) Train h) Taxi
- 30

- 25 In an average week, how many times do you engage in physical activity (exercise or work which lasts at least 20 minutes without stopping and which is hard enough to make you breath heavier and your heart beat faster?)
- a) Less than 1 time per week
- b) 1 or 2 times per week
- c) At least 3 times per week
- 31

- 26 On an average school day, how many hours do you watch Television?
- a) I do not watch TV on school days
- c) I watch TV for hours / minutes per day
- 32

- 27 During the past 12 months, on how many sport teams did you play? (Include any teams run by your school or community sport groups.)
- a) 0 Teams b) 1 Team
- c) 2 Teams d) 3 Or more teams
- 33

Nutrition

- 28 Do you eat some food every day that is high in fiber, such as whole grain bread, cereal, fresh fruits, or vegetables?
- a) Yes
- b) No
- 34

- 29 Do you eat foods every day that are high in cholesterol or fat, such as fatty meats, cheese, fried food, or eggs?
- a) Yes
- b) No
- 35

30 Do you eat at regular times each day?

- a) Yes
- b) No

| |
|---|
| 1 |
| 2 |

| | |
|--|----|
| | 36 |
|--|----|

31 How many days a week do you eat:

1 A Morning Meal?

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5
- f) 6
- g) 7
- h) 0

| | |
|--|----|
| | 37 |
|--|----|

2 A Lunch or Midday Meal?

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5
- f) 6
- g) 7
- h) 0

| | |
|--|----|
| | 38 |
|--|----|

3 An Evening Meal?

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5
- f) 6
- g) 7
- h) 0

| | |
|--|----|
| | 39 |
|--|----|

32 How would you describe your appetite?

- a) Good
- b) Fair
- c) Poor

| |
|---|
| 1 |
| 2 |
| 3 |

| | |
|--|----|
| | 40 |
|--|----|

Socio-economic Details

33 What type of dwelling do you live in?

- a) House
- b) Flat
- c) Back room
- d) Hostels
- e) Shack
- f) Bungalow/Wendy house

| | |
|--|----|
| | 41 |
|--|----|

34 What type of ablution facilities do you have at your house?

- a) In-house flush system
- b) Out-door flush system
- c) Out-door Bucket system
- d) In-house Bucket system

| | |
|--|----|
| | 42 |
|--|----|

Psychology

35 Have you suffered a personal loss or misfortune in the past year that had a serious impact on your life?
(For example, death of someone close to you or disability)
a) Yes 1 b) No 2 43

36 During the past 6 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities.
a) Yes 1 b) No 2 44

37 During the past 6 months, did you ever seriously consider attempting suicide?
a) Yes 1 b) No 2 45

Many thanks for taking part in this survey.

If you choose not to participate in this survey, what was the reason(s) for your non-participation?

_____ 46

PENINSULA TECHNIKON
KINDER OBSITEIT VRAELYS
FAMILIE GESONDHEIDS VERWANTE EN LEWENSTYL GESKIEDENIS



Hoof Ondersoeker Avril Somers

Ondervraer:

Datum van Onderhoud :

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| y | y | m | m | d | d |

Verwysings Nommer:

| | | |
|--|--|--|
| | | |
|--|--|--|

1

Aan die Respondent:

Baie dankie vir jou bereidwilligheid om hierdie vraelys te voltooi.

Die meeste kroniese siektes ontwikkel stadig in die teenwoordigheid van sekere risiko faktore. Hierdie vraelys was geontwikkel om ons van relevante inligting aangaande jou gesondheid, lewenswyse en jou familie se gesondheids geskiedenis te voorsien. Die informasie verkry uit hierdie vraelys sal gebruik word om jou persoonlike risiko om sekere kondisies te ontwikkel, te bepaal.

Voltooiing van Vraelys:

Ek sal graag met die voltooiing van hierdie vraelys wil begin. Geen spesifieke kennis word benodig om hierdie vrae te beantwoord nie. Voel asseblief vry om enige bystand te vra indien enige vrae vir u onduidelik is.

Fisiese Adres:

| |
|--|
| |
| |
| |
| |

Woonadres:

| |
|--|
| |
| |
| |

Telefoon of Selfoon Nommer: (021) _____ (0) _____

Skool Bygewoon:

Primêre of Sekondêre Skool?

| |
|---|
| P |
| S |

*Slegs vir Kantoor
Gebruik*

| | |
|--|--|
| | |
|--|--|

2

3

Persoonlike Data

Instruksies:

Voltooi asseblief die volgende algemene inligting omtrent jousef deur die toepaslike antwoord met n kruisie (x) te merk. Neem asseblief u tyd en lees elke vraag versigtig deur.

- 1 **Wat is jou geboortedatum?**

| | | | | | |
|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| y | y | m | m | d | d |
| <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

| | | |
|----------------------|----------------------|----------------------|
| <input type="text"/> | <input type="text"/> | <input type="text"/> |
|----------------------|----------------------|----------------------|

 4
- 2 **Van watter geslag is jy?**
a) Manlik

| | |
|--------------------------|---|
| <input type="checkbox"/> | 1 |
|--------------------------|---|

b) Vroulik

| | |
|--------------------------|---|
| <input type="checkbox"/> | 2 |
|--------------------------|---|

| |
|----------------------|
| <input type="text"/> |
|----------------------|

 5
- 3 **In watter Graad is jy?**
a) 4de

| | |
|--------------------------|---|
| <input type="checkbox"/> | 0 |
|--------------------------|---|

 b) 5de

| | |
|--------------------------|---|
| <input type="checkbox"/> | 1 |
|--------------------------|---|

 c) 6de

| | |
|--------------------------|---|
| <input type="checkbox"/> | 2 |
|--------------------------|---|

 d) 7de

| | |
|--------------------------|---|
| <input type="checkbox"/> | 3 |
|--------------------------|---|

| |
|----------------------|
| <input type="text"/> |
|----------------------|

 6
e) 8ste

| | |
|--------------------------|---|
| <input type="checkbox"/> | 4 |
|--------------------------|---|

 f) 9de

| | |
|--------------------------|---|
| <input type="checkbox"/> | 5 |
|--------------------------|---|

 g) 10de

| | |
|--------------------------|---|
| <input type="checkbox"/> | 6 |
|--------------------------|---|
- 4 **Hoe lank woon jy al hierdie skool by?**
a) Minder as 6 maande

| | |
|--------------------------|---|
| <input type="checkbox"/> | 0 |
|--------------------------|---|

 b) Minder as een jaar

| | |
|--------------------------|---|
| <input type="checkbox"/> | 1 |
|--------------------------|---|

| |
|----------------------|
| <input type="text"/> |
|----------------------|

 7
c) 1 - 5 jare

| | |
|--------------------------|---|
| <input type="checkbox"/> | 2 |
|--------------------------|---|

 d) 6 - 10

| | |
|--------------------------|---|
| <input type="checkbox"/> | 3 |
|--------------------------|---|
- 5 **Hoe sou jy jousef beskryf?**
a) Swart

| | |
|--------------------------|---|
| <input type="checkbox"/> | 1 |
|--------------------------|---|

 b) Blank

| | |
|--------------------------|---|
| <input type="checkbox"/> | 2 |
|--------------------------|---|

| |
|----------------------|
| <input type="text"/> |
|----------------------|

 8
c) Gekleurd

| | |
|--------------------------|---|
| <input type="checkbox"/> | 3 |
|--------------------------|---|

 d) Asies

| | |
|--------------------------|---|
| <input type="checkbox"/> | 4 |
|--------------------------|---|
- 6 **Waar is jy woonagtig?**
a) Belhar

| | |
|--------------------------|---|
| <input type="checkbox"/> | 1 |
|--------------------------|---|

 b) Delft

| | |
|--------------------------|---|
| <input type="checkbox"/> | 2 |
|--------------------------|---|

 c) Mfuleni

| | |
|--------------------------|---|
| <input type="checkbox"/> | 3 |
|--------------------------|---|

 d) Ander

| | |
|--------------------------|---|
| <input type="checkbox"/> | 4 |
|--------------------------|---|

| |
|----------------------|
| <input type="text"/> |
|----------------------|

 9
- 7 **Hoe lank is jy al by die huidige adres woonagtig?**
a) Minder as 6 maande

| | |
|--------------------------|---|
| <input type="checkbox"/> | 0 |
|--------------------------|---|

 b) Minder as een jaar

| | |
|--------------------------|---|
| <input type="checkbox"/> | 1 |
|--------------------------|---|

| |
|----------------------|
| <input type="text"/> |
|----------------------|

 10
c) 1 - 5 jare

| | |
|--------------------------|---|
| <input type="checkbox"/> | 2 |
|--------------------------|---|

 d) 6 - 10

| | |
|--------------------------|---|
| <input type="checkbox"/> | 3 |
|--------------------------|---|

 e) 10 +

| | |
|--------------------------|---|
| <input type="checkbox"/> | 4 |
|--------------------------|---|
- 8 **Hoeveel mense woon in julle huis (insluitende jou moeder en vader)?**

| | |
|----------------------|----------------------|
| <input type="text"/> | <input type="text"/> |
|----------------------|----------------------|

| | |
|----------------------|----------------------|
| <input type="text"/> | <input type="text"/> |
|----------------------|----------------------|

 11
- 9 **Hoeveel broers en susters het jy?**

| | |
|----------------------|----------------------|
| <input type="text"/> | <input type="text"/> |
|----------------------|----------------------|

| | |
|----------------------|----------------------|
| <input type="text"/> | <input type="text"/> |
|----------------------|----------------------|

 12

FAMILIE GESONDHEIDS GESKIEDENIS

Instruksies:

Die volgende inligting is belangrik ten opsigte van jou familie se gesondheidsgeskiedenis. Voltooi asseblief the volgende vrae deur a kruisie (x) langsaa die toepaslike antwoord te maak of die antwoord in te skryf.

- 10 Is jy al ooit ingelig dat jy Diabetes (suikersiekte) het?
 a) Ja 1 b) Nee 2 13
- 11 Ly jou natuurlike moeder, vader, suster of broer aan:
 Diabetes
 a) Ja 1 b) Nee 2 c) Weet nie 3 14
- 12 Het enige van jou uitgebreide familie (Tannies, Ooms, Oupas of Oumas) al
 ooit gely aan Diabetes?
 a) Ja 1 b) Nee 2 c) Weet nie 3 15
- 13 Indien Ja, sê asseblief wie, en of daardie persoon aan vaderskant of
 moederskant aan jou verwant is. (Moeder/Vader se suster, neef, niggie, etc.)
 a) 16
 b)
 c)
- 14 Het enigeen van jou natuurlike ouers aan 'n hartaanval beswyk voordat
 hulle 60 jaar oud geword het (indien u ouers jonger as 60 is, mark Nee)
 a) Ja, een van hulle 1 b) Ja, altwee van hulle 2 17
 c) Nee 3 d) Onseker 4
- 15 Is jy al ooit ingelig dat u ly aan, of doktersbehandeling ontvang vir:
Hart Probleme
 a) Ja 1 b) Nee 2 18
Angina (Steke op die hart of hartkrampe)
 a) Ja 1 b) Nee 2 19
Pynlike Gewrigte
 a) Ja 1 b) Nee 2 20
- 16 Neem jy medikasie vir hoë bloeddruk?
 a) Ja 1 b) Nee 2 21
- 17 Ly jou natuurlike moeder, vader, suster of broer aan hoë bloeddruk (hyper-
 tensie)?
 a) Ja 1 b) Nee 2 c) Weet nie 3 22
- 18 Kies die antwoord wat jou bloeddruk die beste beskryf:
 a) Hoog 1 b) Normaal 3 23
 c) Laag 2 d) Weet nie 4

19 Op watter ouderdom het jy jou eerste maandstonde gehad?

24

LEEFWYSE

Instruksie:

Beantwoord asseblief die volgende vrae omtrent jou leefwyse en gesondheids optrede deur n kruisie (X) oor die blokkie van jou keuse to maak.

Rook en Alkohol Gebruik

19 Rook jy?

a) Ja

b) Nee

25

20 Hoeveel sigarette rook jy per day?

a) Ek rook nie

26

b) Ek rook sigarette per dag

21 Drink jy enige alkoholiese drankies?

a) Ja

b) Nee

27

22 Wanneer jy gewoonlik alkoholiese drankies drink, hoeveel drankies (glase) drink jy op 'n tipiese dag? (indien jy nooit alkohol drink nie, merk 0)

a) 0

28

b) Ek drink glase per dag

23 Gemiddeld hoeveel dae per week drink jy alkohol?

a) 1

b) 2

c) 3

29

d) 4

e) 5

f) 6

g) 7

h) Een - twee keer per maand

Fisiese Aktiviteite

24 Hoe kom jy op 'n tipiese dag GEWOONLIK oor die weg?

(Merk slegs een)

a) Stap

b) Fiets

c) Motorfiets

30

d) Motor

e) Vragmotor

f) Bus

g) Trein

h) Huurmotor / Taxi

25 In 'n gemiddelde week, hoeveel keer (dae) doen julle fisiese aktiviteite (oefening of werk wat minstens 20 minute aanhou sonder om te stop), en wat swaar genoeg is om jou swaarder te laat asemhaal en jou hart vinniger laat klop?

a) Minder as een keer per week

a) Een of Twee keer per week

a) Minstens Drie keer per week

31

- 26 Op 'n gewone skooldag, hoeveel ure kyk jy Televisie?
 a) Ek kyk nie TV op skooldae nie 32
 b) Ek kyk TV vir ure / min per dag.

- 27 In hoeveel sportspanne het jy die gedurende die afgelope 12 maande deel-
 geneem (sluit alle spanne in wat deur jou skool of gemeenskap gereël
 word.)
 a) 0 Spanne b) 1 Span 33
 c) 2 Spanne d) 3 Of meer spanne

Voeding

- 28 Eet jy sommige kos wat baie vesel bevat, byvoorbeeld
 volgraan brood, graankos, vars vrugte, of groente?
 a) Ja b) Nee 34

- 29 Eet u jy elke dag kosse wat baie cholesterol of vet bevat, byvoorbeeld
 vetterige vleis, kaas, gebraaide kos, of eiers?
 a) Ja b) Nee 35

- 30 Eet jy jou maaltye of gereelde tye elke dag?
 a) Ja b) Nee 36

- 31 Hoeveel dae per week nuttig (eet) jy 'n:
 1 Ontbyt?
 a) 1 b) 2 c) 3 d) 4 37
 e) 5 f) 6 g) 7 h) 0

- 2 Middagete?
 a) 1 b) 2 c) 3 d) 4 38
 e) 5 f) 6 g) 7 h) 0

- 3 Aandete?
 a) 1 b) 2 c) 3 d) 4 39
 e) 5 f) 6 g) 7 h) 0

- 32 Hoe sou jy jou eetlus beskryf?
 a) Goed b) Redelik c) Swak 40

- 33 In watter tipe woning is jy woonagtig? 41
- a) Huis 1 b) Woonstel 2 c) Agterkamer 3
- d) Hostelle 4 e) Pondok 5 d) Bungalow 6

- 34 Watter tipe was/ stort/ toilet / ablusiegeriewe het jy tuis? 42
- a) Binnenshuise Spoelsisteam 1 b) Buite-huise Spoelsisteam 2
- c) Buitenshuise Emmerstelsel 3 d) Binnenshuise Emmerstelsel 4

Sielkunde

- 35 Het jy die afgelope jaar enige persoonlike verlies of ongeluk ervaar wat 'n ernstige invloed op jou lewe gehad het? (Byvoorbeeld, dood of ongeskiktheid van naasbestaande of vriend) 43
- a) Ja 1 b) Nee 2

- 36 Het jy ooit gedurende die afgelope 6 maande daaglik, en aaneen vir twee weke of meer so hartseer en verlore gevoel, dat jy sommige van jou gewone aktiwiteite gestaak het. 44
- a) Ja 1 b) Nee 2


- 37 Het jy ooit gedurende die afgelope 6 maande ernstig gedink aan selfmoord pleeg? 45
- a) Ja 1 b) Nee 2

Baie Dankie vir u Deelname aan Hierdie Vraelys

Indien jy besluit om nie aan hierdie ondersoek deel te neem nie, wat is u rede(s) vir jou onbetrokkenheid?

46

PENINSULA TECHNIKON
CHILDHOOD OBESITY QUESTIONNAIRE
PHYSICAL ACTIVITY AND ENERGY EXPENDITURE



Principal Interviewer: **Avril Somers**

Name of Interviewer:

Date of interview:

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| y | y | m | m | d | d |

Reference Number:

| | | |
|--|--|--|
| | | |
|--|--|--|

 1

To the Respondent:

Thank you very much for the willingness to participate in the completion of this questionnaire. This questionnaire has been developed to provide us with relevant information about your usual leisure time and physical activity. The questionnaire should not take too long to complete, and we hope you will find it interesting and enjoyable. All responses to questions posed, will be treated as confidential and anonymous.

Completing the Questionnaire:

I am now going to administer the questionnaire. Please feel free to ask for further assistance if any of the questions are not clearly understood.

Physical Address: _____

Residential Address: _____

Telephone or Cellphone Number: (021) _____ (0) _____

School attended:

Primary or Secondary School?

| |
|---|
| P |
| S |

For Official Use Only

2

3

1 **If you walk to school, how far do you have to travel to get to school?**
a) I never walk 0
b) Less than 200 meters 1
c) 200 - 500 meters 2
d) More than 500 meters, but less than 1 000 meters 3
e) More than a 1 000 meters 4

2 **Do you have a Television at home?**
a) Yes 1
b) No 2

3 **Do you have a TV game or computer games (such as playstation) at home?**
a) Yes 1
b) No 2

4 **If your answer to (3) was yes, on an average school day, how many hours per day do you play TV or computer games?**
a) I do not watch TV on school days 0
b) I play games for hours / minutes at the game centers

5 **In a typical week, how many times (days) do you visit game centers or arcades?**
a) I do not visit arcades 0
b) I visit the arcade/game centers times per week

6 **How many hours do you usually spend at these game centers or arcades?**
a) 0 0
b) I spend hours and minutes at the game centers

7 **Do you usually go to the movies (cinema)?**
a) Yes 1
b) No 2

6 **If yes, how often do you go to the movies?**
a) Weekly 1
b) Monthly 2
c) Quarterly 3
d) Annually 4

7 **How many days per week do you visit shopping malls?**
a) I do not go to shopping malls 0
c) I go to shopping malls at least days per week

8

How do you usually travel to the shops?

- a) Walk 1
- b) Bicycle 2
- c) Motorcycle 3
- d) Car 4
- e) Truck or Van 5
- f) Bus 6
- g) Train 7
- h) Taxi 8

13

9

How many hours do you usually spend at these shopping malls?

- a) 0
- b) I spend hours / minutes at the shopping mall

14

10

Do you have any household chores (duties) that you have to perform at your house? If yes, please list those chores and mention whether they are performed daily or weekly (weekends included)

15

Chores=1, No chores=0

11

Do you participate in sports

- a) Yes 1
- b) No 2

16

12

If your answer to (9) was yes, what sports do you play?

- a) Chess 1
- b) Tennis 2
- c) Rugby 3
- d) Swimming 4
- e) Netball 5
- f) Cricket 6
- g) Soccer 7
- h) Table tennis 8
- g) Other 7

17

13

In an average week at school, on how many days do you go to physical education (PE) classes?

- a) 0 Days 0
- b) 1 Day 1
- c) 2 Days 2
- d) 3 Days 3
- e) 4 or More Days 4

18

14

During an average physical education (PE) class, how many minutes do you spend actually exercising or playing sports?

a) I do not take PE 1

b) < 10 Minutes 2

19

c) 10 to 20 Minutes 3

d) > 30 Minutes 4

Many thanks for taking part in this survey

If you choose not to participate in this survey, what was the reason(s) for your non-participation?

20

PENINSULA TECHNIKON
KINDER OBESITEITS VRAELYS
FISIESE AKTIWITEIT VRAELYS



Hoof Ondersoeker

Avril Somers

Ondervraer:

Datum van Onderhoud :

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| y | y | m | m | d | d |

Verwysings Nommer:

1

Aan die Respondent:

Baie dankie vir u bereidwilligheid om hierdie vraelys te voltooi. Die vraelys is ontwerp om ons van relevante inligting aangaande jou normale ontspannings en fisiese aktiwiteite te voorsien. Die vraelys behoort nie te lank te neem nie. Ons hoop u sal dit geniet en interessant vind. Die antwoorde wat u verskaf sal as vertroulik en anoniem hanteer word.

Voltooiing van Vraelys:

Ek sal graag met die voltooiing van hierdie vraelys wil begin. Geen spesifieke kennis word benodig om hierdie vrae te beantwoord nie. Voel asseblief vry om enige bystand te vra indien enige vrae vir u onduidelik is.

Fisiese Adres:

Woonadres:

Telefoon of Selfoon Nommer:

(021) _____ (0) _____

Skool Bygewoon:

Primêre of Sekondêre Skool?

| |
|---|
| P |
| S |

Slegs vir
Kantoor
Gebruik

2

3

- 1 Indien jy stap, hoe ver moet jy stap om by die skool te kom?
- a) Minder as 200 meter 4
 b) 200 - 500 meter
 c) Meer as 500 meter, maar minder as 1 000 meters
 d) Meer as 1 000 meters
- 2 Is daar 'n Televisie (TV) stel by jou huis? 5
- a) Ja b) Nee
- 3 Besit jy 'n TV speletjie of rekenaarspeletjies (soos Playstation) tuis? 6
- a) Ja b) Nee
- 4 Indien jou antwoord by (6) Ja was, op 'n gewone skooldag, hoeveel ure per dag speel jy met hierdie TV of rekenaarspeletjies? 7
- a) Ek speel nie rekenaar of TV speletjies op skooldae nie
 b) Ek speel rekenaar of TV speletjies vir hours / per day
- 5 In 'n tipiese week, hoeveel keer (dae) besoek jy arkades of speletjiesentrums? 8
- a) Ek besoek nie die arkade nie
 b) Ek besoek die arkade dae per week
- 6 Hoeveel ure spandeer jy gewoonlik by hierdie speletjiesentrums of arcades? 9
- a) 0
 b) Ek spandeer gewoonlik ure / min by die arkade
- 7 Besoek jy gewoonlik die fliek (Bioskoop)? 10
- a) Ja b) Nee
- 8 Indien Ja, hoe gereeld gaan jy na die bioskoop (fliek)? 11
- a) Weekliks b) Maandeliks
 c) Kwartaaliks d) Jaarliks
- 9 Hoeveel dae per week besoek jy winkel sentrums? 12
- a) Ek besoek nie winkel sentrums nie
 c) Ek besoek die sentrum minstens dae per week

10 Hoe kom jy gewoonlik by die winkels uit? 13

a) Stap 1 b) Fiets 2 c) Motorfiets 3

d) Motor 4 e) Vragmotor 5 f) Bus 6

g) Trein 7 f) Taxi 8

11 Hoeveel ure spandeer jy gewoonlik by die winkel sentrums? 14

a) 0 0

b) Ek spandeer ure / minute by die winkel sentrum.

12 Het jy enige huishoudelike takies (pligte) wat jy tuis doen? Indien Ja, lys asseblief daardie takies and noem of jy dit weekliks of daagliks doen. (naweke ingesluit) 15

13 Neem jy deel aan enige sportsoorte? 16

a) Ja 1 b) Nee 2

14 Indien jou antwoord by (9) Ja was, in watter sportsoorte neem jy deel? 17

a) Skaak 1 b) Tennis 2 c) Rugby 3

d) Swem 4 e) Netbal 5 f) Krieket 6

g) Sokker 7 h) Tafeltennis 8 g) Ander 9

15 In 'n gewone week, hoeveel dae doen kry julle ligoamlike opvoeding (LO) klasse? education (PE) classes? 18

a) 0 Dae 0 b) 1 Dag 1 c) 2 Dae 2

d) 3 Dae 3 e) 4 of Meer Dae 4

16 Gedurende 'n gewone ligoamlike opvoeding (LO) klas, hoeveel minute spandeer julle eintlik aan oefeninge of deur sports te doen? 19

a) Ek doen nie LO nie 1 b) < 10 Minute 2

c) 10 to 20 Minute 3 d) > 30 Minute 4

Baie Dankie vir u Deelname aan Hierdie Vraelys

Indien jy besluit om nie aan hierdie ondersoek deel te neem nie, wat is u rede(s) vir jou onbetrokkenheid?

21

**PENINSULA TECHNIKON
CHILDHOOD OBESITY QUESTIONNAIRE
FOOD CONSUMPTION FREQUENCY CHECKLIST**



Principal Interviewer: Avril Somers

Name of Interviewer:

Date of interview:

| | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| y | y | m | m | d | d |

Reference Number:

| | | |
|--|--|--|
| | | |
|--|--|--|

 1

To the Respondent:

Thank you very much for the willingness to participate in the completion of this questionnaire. The information obtained from this questionnaire will enable us to establish the correlation between your dietary intake and the physical state of your body. The questionnaire should not take too long to complete, and we hope you will find it interesting and enjoyable. All responses to questions posed, will be treated as confidential and anonymous.

Completing the Questionnaire:

I would now like to start administering the questionnaire. Please feel free to ask for further assistance if any of the questions are not clearly understood.

Physical Address: _____

Residential Address: _____

Telephone or Cellphone Number: (021) _____ (0) _____

School attended:

Primary or Secondary School?

| |
|---|
| P |
| S |

Gender:

| | |
|---|---|
| M | F |
|---|---|

Date of Birth

| | | | | | |
|---|---|---|---|---|---|
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| y | y | m | m | d | d |

Official use only

2

3

4

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 5

6 How many times per day do you drink the following beverages? (at any meal or between meals) Mark the appropriate number with an X.

| | | Daily Intake | | | | | | | | |
|---|-------------------------------|--------------|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 6 | Fruit Juice | | | | | | | | | |
| 6 | Milk (full cream) | | | | | | | | | |
| 6 | Milk (Skim) | | | | | | | | | |
| 6 | Milk (2%) | | | | | | | | | |
| 6 | Artificially sweetened drinks | | | | | | | | | |
| 6 | Soft drinks(Fanta, Coke, etc) | | | | | | | | | |
| 6 | Coffee | | | | | | | | | |
| 6 | Tea | | | | | | | | | |

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| | | 24 |
| | | 25 |
| | | 26 |
| | | 27 |
| | | 28 |

7 How many days per week do you drink the following beverages? (at any meal or between meals) Mark the appropriate number with an X.

| | | Weekly Intake | | | | | | | | |
|---|--------------|---------------|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 7 | Beer | | | | | | | | | |
| 7 | Diet Shakes | | | | | | | | | |
| 7 | Fruit Juice | | | | | | | | | |
| 7 | Whiskey | | | | | | | | | |
| 7 | Wine | | | | | | | | | |
| 7 | Vodka or Rum | | | | | | | | | |

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| | | 29 |
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| | | 31 |
| | | 32 |
| | | 33 |
| | | 34 |

8 How many times per week do you eat the following foods? (at any meal or between meals) Mark the appropriate number with an X

| | | Weekly Intake | | | | | | | | |
|---|--------------------------|---------------|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 8 | Yogurt | | | | | | | | | |
| 8 | Peanut Butter | | | | | | | | | |
| 8 | Ice cream (tubs) | | | | | | | | | |
| 8 | Ice cream (Mega, Magnum) | | | | | | | | | |
| 8 | Cheese | | | | | | | | | |
| 8 | Cheese dishes | | | | | | | | | |
| 8 | Butter or margarine | | | | | | | | | |
| 8 | Frozen Sweets (JC's) | | | | | | | | | |
| 8 | Jam or syrup | | | | | | | | | |
| 8 | Breakfast Bars | | | | | | | | | |
| 8 | Chocolate | | | | | | | | | |
| 8 | lollypops | | | | | | | | | |

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| | | 44 |
| | | 45 |
| | | 46 |

9 How many times per week do you eat the following foods? (at any meal or between meals)Mark the appropriate number with an X.

| | | Weekly Intake | | | | | | | | |
|---|---------------|---------------|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | Pizza | | | | | | | | | |
| 9 | Pies | | | | | | | | | |
| 9 | Fish (fresh) | | | | | | | | | |
| 9 | Fish (Canned) | | | | | | | | | |
| 9 | Bacon | | | | | | | | | |
| 9 | Tongue | | | | | | | | | |
| 9 | Chicken Feet | | | | | | | | | |
| 9 | Sausage | | | | | | | | | |

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| | | 54 |

- 9 Cold Meats
- 9 Hot dogs
- 9 Chicken Liver
- 9 Liver -other
- 9 Chicken Heads

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

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| | | 55 |
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| | | 58 |
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**10 How many times per week do you eat the following foods?
(at any meal or between meals)Mark the appropriate number with an X.**

Weekly Intake

- 10 Poultry
- 10 Pork or Ham
- 10 Bones (neck or other)
- 10 Mince Meat
- 10 Dried Meat (Biltong)
- 10 Meat in mixtures (stew)
- 10 Beef or Veal
- 10 Other Meat
- 10 Hamburgers
- 10 Eggs
- 10 Fast food

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

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| | | 60 |
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**11 How many times per week do you eat the following foods?
(at any meal or between meals)Mark the appropriate number with an X.**

Weekly Intake

- 11 Fruit
- 11 Cereal (Dry - Kellogs)
- 11 Cereal (Cooked or instant)
- 11 Potato
- 11 Potato Chips (Simba)
- 11 Hot Chips
- 11 Raw Vegetables
- 11 Other Vegetables
- 11 Salad with Raw Vegetables)
- 11 Salad with Salad Dressing
- 11 Dried Beans
- 11 Lentils
- 11 Sweets
- 11 Peas
- 11 Macaroni
- 11 Spaghetti
- 11 Samp
- 11 Rice
- 11 Noodles
- 11 Maize meal (pap)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

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12 How many days per week do you have snacks?

In Mid-morning

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|

and what do you have then?

| | |
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| | 91 |
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| | |
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| | 92 |
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In Mid-afternoon

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|

and what do you have then?

93

94

In The Evening

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|

and what do you have then?

95

96

During the Night

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|

and what do you have then?

97

98

Many Thanks for taking part in this survey

If you choose not to participate in this survey, what was the reason(s) for your non-participation?

99

| Time | Where eaten* | Food | Type &/or preparation** | Amount | Food code | Amount Code |
|------|--------------|------|-------------------------|--------|-----------|-------------|
| | | | | | | |
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***Code**

H - Home

C - Cafee

CL - Carried lunch from home

OH - Other home (friend, relative, care-taker, etc.)

S - School

TS - Tuck shop at school

** Please state whether it was fried, cooked, frozen or boiled. In the case of bread, please state whether it was white, brown, whole grain, or toasted

- 1 Hoeveel keer per week eet jy gewoonlik weg van die huis? (restaurante, weg-neem etes, ens.)
- a) Nooit b) Een keer per week
- c) Twee keer per week d) 3 - 4 keer per week
- e) Elke dag

- 2a Is jy op 'n spesiale dieët?
- a) Ja b) Nee

- 2b Indien jou antwoord by 2a ja was, was dit om:
- a) Gewig te verloor b) Gewig op te tel
- c) Gesondheids redes d) Ander
- Indien ander, spesifiseer _____

- 4a Is daar enige kosse wat jy om een of ander redes nie eet nie?
- a) Ja b) Nee

- 4b Indien jou antwoord by 4a ja was, wat is hierdie rede(s)?
- _____
- _____
- _____

Die volgende lys sal ons help om jou normale eetgewoontes te verstaan.

- 5 Hoeveel keer per dag eet jy die volgende kosse? Merk die toepaslike antwoord met 'n kruisie (X).

| | Daaglikse Inname | | | | | | | | | | |
|----------------------|------------------|---|---|---|---|---|---|---|---|---------------------------------|--|
| 5 Brood | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | <input type="text" value="11"/> | |
| 5 Koek | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | <input type="text" value="12"/> | |
| 5 Koekies of Beskuit | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | <input type="text" value="13"/> | |
| 5 Muffins | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | <input type="text" value="14"/> | |
| 5 Pannekoeke | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | <input type="text" value="15"/> | |
| 5 Waffles | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | <input type="text" value="16"/> | |
| 5 Koek rolle | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | <input type="text" value="17"/> | |
| 5 Doughnuts | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | <input type="text" value="18"/> | |
| 5 Vetkoeke | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | <input type="text" value="19"/> | |

- 6 Hoeveel keer per dag drink jy die volgende drankies? (tydens enige maaltyd of tussen maaltye) Merk the toepaslike antwoord met 'n kruisie (X).

| | Daaglikse Inname | | | | | | | | | | |
|------------------|------------------|---|---|---|---|---|---|---|---|---------------------------------|--|
| 6 Vrugtesap | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | <input type="text" value="20"/> | |
| 6 Melk (volroom) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | <input type="text" value="21"/> | |
| 6 Melk (Skim) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | <input type="text" value="22"/> | |

- 6 Melk (2%)
- 6 Nagemaakte soet drankies
- 6 Gaskoel drankie (Fanta, Coke)
- 6 Koffie
- 6 Tee

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

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7 Hoeveel keer per week drink jy die volgende drankies? (tydens enige maaltyd of tussen maaltye) Merk the toepaslike antwoord met 'n kruisie (X).

Weeklikse Inname

- 7 Bier
- 7 Dieët Melkskommels
- 7 Vrugtesap
- 7 Whiskey
- 7 Wyn
- 7 Vodka of Rum

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

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- 29
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- 32
- 33

8 Hoeveel keer per week eet jy die volgende kosse? Merk die toepaslike antwoord met met 'n kruisie (X).

Weeklikse Inname

- 8 Jogurt
- 8 Grondboontjie Botter
- 8 Roomys (Bakke)
- 8 Roomys (Mega, Magnum)
- 8 Kaas
- 8 Kaas Kosse
- 8 Botter of margarien
- 8 Bevore Lekkers (JC's)
- 8 Konfyt of stroop
- 8 Gesondheids Stafies
- 8 Sjokolade
- 6 Stokkielekkers

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

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- 35
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- 40
- 41
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- 43
- 44
- 45

9 Hoeveel keer per week eet jy die volgende kosse? Merk die toepaslike antwoord met met 'n kruisie (X).

Weeklikse Inname

- 9 Pizza
- 9 Pasteie
- 9 Vis (Vars)
- 9 Vis (Ingemaak)
- 9 Spek
- 9 Tong
- 9 Hoender Pote
- 9 Wors
- 9 Koue Vleis
- 9 Worsrolle
- 9 Hoender Lewers
- 9 Lewer - Ander
- 9 Hoenderkoppe

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

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- 47
- 48
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- 54
- 55
- 56
- 57
- 58

10 Hoeveel keer per week eet jy die volgende kosse? Merk die toepaslike antwoord met met 'n kruisie (X).

Weeklikse Inname

| | | | | | | | | | | |
|----|-----------------------------|---|---|---|---|---|---|---|---|---|
| 10 | Hoender | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 10 | Vark of Ham | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 10 | Bene (nek of ander) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 10 | Gemaalde Vleis | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 10 | Gedroogde Vleis (Biltong) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 10 | Vleis in mengsels (bredies) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 10 | Bief of Skaapvleis | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 10 | Ander Vleis | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 10 | Hamburgers | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 10 | Eiers | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 10 | Wegneem Etes | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

| | |
|--------------------------|----|
| <input type="checkbox"/> | 59 |
| <input type="checkbox"/> | 60 |
| <input type="checkbox"/> | 61 |
| <input type="checkbox"/> | 62 |
| <input type="checkbox"/> | 63 |
| <input type="checkbox"/> | 64 |
| <input type="checkbox"/> | 65 |
| <input type="checkbox"/> | 66 |
| <input type="checkbox"/> | 67 |
| <input type="checkbox"/> | 68 |
| <input type="checkbox"/> | 69 |

11 Hoeveel keer per dag eet jy die volgende kosse? Merk die toepaslike antwoord met met 'n kruisie (X).

Weeklikse Inname

| | | | | | | | | | | |
|----|---------------------------|---|---|---|---|---|---|---|---|---|
| 11 | Vrugte | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Ontbyt graankos (Kellogs) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Ontbyt graankos (gekook) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Aartappels | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Aartappel skyfies (Simba) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Warm aartappelskyfies | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Rou Groente | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Ander Groente | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Slaaie met rou groente | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Slaaie met slaaisous | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Gedroogde Boontjies | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Lensies | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Lekkers | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Ertjies | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Macaroni | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Spaghetti | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Stampmielies | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Rys | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Noodles | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 11 | Mielie meel (pap) | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

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| <input type="checkbox"/> | 70 |
| <input type="checkbox"/> | 71 |
| <input type="checkbox"/> | 72 |
| <input type="checkbox"/> | 73 |
| <input type="checkbox"/> | 74 |
| <input type="checkbox"/> | 75 |
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| <input type="checkbox"/> | 78 |
| <input type="checkbox"/> | 79 |
| <input type="checkbox"/> | 80 |
| <input type="checkbox"/> | 81 |
| <input type="checkbox"/> | 82 |
| <input type="checkbox"/> | 83 |
| <input type="checkbox"/> | 84 |
| <input type="checkbox"/> | 85 |
| <input type="checkbox"/> | 86 |
| <input type="checkbox"/> | 87 |
| <input type="checkbox"/> | 88 |
| <input type="checkbox"/> | 89 |

12 Hoeveel dae per week neem jy enige peuselhapies (bv. skyfies en lekkers)?

Gedurende die oggend

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|

| | |
|--------------------------|----|
| <input type="checkbox"/> | 90 |
|--------------------------|----|

Wat geniet jy dan?

| | |
|--------------------------|----|
| <input type="checkbox"/> | 91 |
|--------------------------|----|

Gedurende die namiddag

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|

| | |
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| <input type="checkbox"/> | 92 |
|--------------------------|----|

Wat geniet jy dan?

| | |
|--------------------------|----|
| <input type="checkbox"/> | 93 |
|--------------------------|----|

In die Aand

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
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|--------------------------|----|

Wat geniet jy dan?

95

Gedurende die Nag

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|

96

Wat geniet jy dan?

97

Baie Dankie vir u Deelname aan Hierdie Vraelys

Indien jy besluit om nie aan hierdie ondersoek deel te neem nie, wat is u rede(s) vir jou onbetrokkenheid?

98

| Time | Where eaten* | Food | Type &/or preparation | Amount | Food code | Amount Code |
|------|--------------|------|-----------------------|--------|-----------|-------------|
| | | | | | | |
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***Kode**

H - Huis


C - Kafee

LH - Middig ete van huis gebring Carried lunch from home

OH - Ander huis (vriend, familielid, versorger, ens.)

S - Skool

TS - Snoepwinker by die Skool

| | |
|---|---|
|  | <p>PENINSULA TECHNIKON BODY MEASUREMENTS DATA COLLECTION SHEET</p> |
|---|---|

Principal Interviewer: Avril Somers

Reference Number:

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Date of interview:

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|---|------------------|--|--|--|--|---|--|
| 1 | Body Weight (kg) | | | | | . | |
| | Body Height (cm) | | | | | . | |

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4

CIRCUMFERENCE MEASUREMENTS

| | | | | | | | |
|---|------------------------------------|--|--|--|--|---|--|
| 2 | Mid-upper Arm Circumference 1 (cm) | | | | | . | |
| | Mid-upper Arm Circumference 2 (cm) | | | | | . | |
| | Mid-upper Arm Circumference 3 (cm) | | | | | . | |
| | Mid-upper Arm Circumference (cm) | | | | | . | |

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|---|-------------------------------|--|--|--|--|---|--|
| 3 | Waist Circumference (cm) | | | | | . | |
| | Waist Circumference (cm) | | | | | . | |
| | Waist Circumference (cm) | | | | | . | |
| | Hip Circumference (cm) | | | | | . | |
| | Hip Circumference (cm) | | | | | . | |
| | Hip Circumference (cm) | | | | | . | |
| | Waist Hip Circumference Ratio | | | | | . | |

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8

BLOOD PRESSURE MEASUREMENTS

| | | | | |
|---|----------------------------|--|--|--|
| 4 | Systolic Pressure 1 (mmHg) | | | |
| | Systolic Pressure 2 (mmHg) | | | |
| | Systolic Pressure 3 (mmHg) | | | |

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| 5 | Diastolic Pressure 1 (mmHg) | | | |
| | Diastolic Pressure 2 (mmHg) | | | |
| | Diastolic Pressure 3 (mmHg) | | | |

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10

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| 6 | Pulse 1 (Beats per minute) | | | |
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11

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| Pulse 2 (Beats per minute) | | | |
| Pulse 3 (Beats per minute) | | | |

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|---|---------------------------|--|--|--|
| 7 | Systolic Pressure (mmHg) | | | |
| | Diastolic Pressure (mmHg) | | | |

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| | | | | 12 |
| | | | | 13 |

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| 8 | Time of First Blood Pressure | | | h | | |
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9 BLOOD GLUCOMETER ANALYSES

| | | | | | |
|--------------------------------------|--|--|---|--|--|
| Glucose mmol/l | | | . | | |
| Cholesterol mmol/l (L=1, N=2, H=3) | | | . | | |
| Triglycerides mmol/l (L=1, N=2, H=3) | | | . | | |

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| | | . | | | 15 |
| | | . | | | 16 |
| | | . | | | 17 |

10 URINALYSIS

| | | | | |
|----------------------------------|--|--|---|---|
| Glucose (N=Negative, P=Positive) | | | P | N |
| Protein (N=Negative, P=Positive) | | | P | N |

| | | |
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| | | 18 |
| | | 19 |

| | | | | | | |
|----|---------------------------|--|--|---|--|--|
| 11 | Percentage Body Fat (%) | | | . | | |
| | Body Fat (kg) | | | . | | |
| | Percentage Lean Body Mass | | | . | | |
| | Lean Body Mass | | | . | | |
| | Total Body Mass | | | . | | |
| | Body Mass Index | | | . | | |
| | Impedance Measurement | | | . | | |

| | | | | | |
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| | | . | | | 20 |
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| | | . | | | 24 |
| | | . | | | 25 |
| | | . | | | 26 |

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|----|-------------------------------|-----|--|---|
| 12 | Did Subject Eat this morning? | Yes | | 1 |
| | | No | | 2 |

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| | | 27 |
| | | 28 |

Annex 8: Protocol for Urine Collection

You will be provided with a sterile, plastic, screw-cap container for the specimen. Please do not open the container until immediately prior to use. Please follow the instructions carefully to ensure proper specimen collection and valid and accurate analysis.

For Males:

1. Wash your hands thoroughly before collection.
2. Pull back the foreskin of the penis.
3. Wipe the glans penis with a swab dipped in sterile (saline) water. The observer will provide the swab to you.
4. Pass a little urine in the urinal.
5. Cut-off the stream and pass urine directly into the specimen bottle without allowing the glans penis to touch it.
6. Fill the specimen bottle until half.
7. After filling the bottle with the required amount of urine, you may empty the bladder as normal.

For Females:

1. Wash your hands thoroughly before collection.
2. Clean the vulva and vestibule thoroughly by wiping it with the saline-soaked swab. The observer will provide the swab to you.
3. Separate the labia while passing a little urine into the toilet.
4. Cut-off the stream and slip the sterile specimen bottle into position to catch the urine specimen.
5. Fill the specimen bottle until half.
6. After filling the bottle with the required amount of urine, you may empty the bladder as normal.

Take the paper towel provided to you and wrap it around the specimen bottle to avoid soiling the label.

Hand the specimen immediately over to the observer.

**PENINSULA TECHNIKON
COMPREHENSIVE HEALTH-RELATED QUESTIONNAIRE
TO PARENTS**



Principal Investigator: Avril Somers

Interviewer:

Date of interview:

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Reference Number:

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 1

To the Respondent:

Thank you very much for your willingness to participate in the completion of this questionnaire. The information obtained from this questionnaire will provide us with information on all the possible health, familial and lifestyle, and dietary risk factors within your household that might influence the health and well-being of your child. The questionnaire should not take long, and we hope you will find it interesting and enjoyable. The answers provided will be treated as confidential and anonymous.

Completing the Questionnaire:

The questions cover a wide range of subjects, but can be answered simply by placing a cross (X) over one of the boxes of your choice. No special knowledge is required to answer these questions, but please feel free to ask for further assistance if any of the questions are not clearly understood.

Physical Address: _____

Residential Address: _____

Telephone or Cellphone Number: (021) _____ (0) _____

Personal Data

Instructions:

Please complete the following general information about yourself by ticking the appropriate answer. Please, take your time and read each question carefully.

For official use only

- 10 What type of dwelling do you live in?
- a) House 1 b) Flat 2 c) Back room 3 12
- d) Hostels 4 e) Shack 5

- 11 How many people are in living in your house
- a) 2 1 b) 3 2 c) 4 3 d) 5 4 13
- e) 6 5 f) 7 or more 6

FAMILY HEALTH HISTORY

Instruction:

The following questions will tell us about your family health history.

Please complete all the questions by placing a tick next to the appropriate answer or writing in the answer.

- 12 Have you ever been told that you have Diabetes?
- a) Yes 1 b) No 2 14

- 13 Does your natural mother, father, sister or brother have Diabetes
- a) Yes 1 b) No 2 15

Insulin Resistance

- a) Yes 1 b) No 2 16

Glucose Intolerance

- a) Yes 1 b) No 2 17

- 14 Does your child or any of his/her siblings suffer from or have they ever been treated for:
- Diabetes
- a) Yes 1 b) No 2 18

Insulin Resistance

- a) Yes 1 b) No 2 19

Glucose Intolerance

- a) Yes 1 b) No 2 20

- 15 Does your husband/wife suffer from or has/she he ever been treated for:
- Diabetes
- a) Yes 1 b) No 2 21

Insulin Resistance

- a) Yes 1 b) No 2 22

Glucose Intolerance

a) Yes 1

b) No 2

23

16 Has anyone in your extended family (Aunts, Uncles, Grandfather or Grandmother) ever suffered from Diabetes?

a) Yes 1

b) No 2

24

17 Did either of your natural parents die of a heart attack before the age of 60? (if your parents are younger than 60, mark No)

a) Yes, one of them 1

b) Yes, both of them 2

25

c) No 3

d) Not sure 4

18 Have you ever been told that you suffer from, and/or treated by a doctor for: Heart Problems

a) Yes 1

b) No 2

26

Hypertension

a) Yes 1

b) No 2

27

High Cholesterol

a) Yes 1

b) No 2

28

19 Does your natural mother, father, sisters or brothers suffer from, or ever been treated for: Heart Problems

a) Yes 1

b) No 2

29

Hypertension

a) Yes 1

b) No 2

30

High Cholesterol

a) Yes 1

b) No 2

31

20 Does your child or any of his/her siblings suffer from or have they ever been treated for: Heart Problems

a) Yes 1

b) No 2

32

Hypertension

a) Yes 1

b) No 2

33

High Cholesterol

a) Yes 1

b) No 2

34

21 Does your husband/wife suffer from or has he/she ever been treated for: Heart Problems

a) Yes 1

b) No 2

35

Hypertension

a) Yes 1

b) No 2

36

High Cholesterol

a) Yes 1

b) No 2

37

22 What was your child's weight at birth?

38

Physical Activity

23 On a typical day how does your family USUALLY travel? (Check only one)

a) Walk 1

b) Bicycle 2

c) Motorcycle 3

39

d) Car 4

e) Truck or Van 5

f) Bus, or Train 6

24 On an average school day, how many hours does your child watch Television?

a) He/she does not watch TV on school days

40

b) He/She watches TV for hours per day

Nutrition

25 Does your child/family eat some food every day that is high in fiber, such as whole grain bread, cereal, fresh fruits, or vegetables?

a) Yes 1

b) No 2

41

26 Does your child/family eat foods every day that are high in cholesterol or fat, such as fatty meats, cheese, fried food, or eggs?

a) Yes 1

b) No 2

42

27 Does your child eat at regular times each day?

a) Yes 1

b) No 2

43

28 How many days a week does your child eat:

1 A Morning Meal?

a) 1 1

b) 2 2

c) 3 3

d) 4 4

44

e) 5 5

f) 6 6

g) 7 7

2 A Lunch or Midday Meal?

a) 1 1

b) 2 2

c) 3 3

d) 4 4

45

e) 5 5

f) 6 6

g) 7 7

3 An Evening Meal?

**PENINSULA TECHNIKON
KOMPREHENSIEWE GESONDHEIDSVERWANTE
VRAELYS AAN OUERS**



Hoof Ondervraer: Avril Somers

Ondervraer:

Datum van Onderhoud : / /

Verwysings Nummer:

Aan die Respondent:

Baie dankie vir u bereidwilligheid om hierdie vraelys te voltooi. Die inligting verkry uit hierdie vraelys sal aan ons inligting verskaf aangaande al die gesondheid, familieël en leefwyse, asook die dieetverwante risikofactore in u huishouding wat die gesondheid and welsyn van u kind mag beïnvloed. Die vraelys behoort nie te lank te neem nie en ons hoop u sal dit geniet en interessant vind. Die antwoorde wat u verskaf sal as vertroulik en anoniem hanteer word.

Voltooiing Van Die Vraelys:

Die vrae dek 'n wye reeks onderwerpe, maar geen spesifieke kennis word benodig om hierdie vrae te beantwoord nie. Voel asseblief vry om enige bystand te vra indien enige vrae vir u onduidelik is. Ek sal nou met die toepassing van die vraelys begin.

Fisiese Adres:

Woonadres:

Telefoon of Selfoon Nummer: (021) _____ (0) _____

Persoonlike Data

Instruksies:

Voltooi asseblief die volgende algemene inligting omtrent uself deur die toepaslike antwoord met n kruisie (x) te merk. Neem asseblief u tyd en lees elke vraag versigtig deur.

- 1 **Wat is u verwantskap met die kind?**
- | | | | | |
|---|---|---|--|---|
| a) Moeder <input style="width: 20px; height: 15px;" type="text"/> | b) Vader <input style="width: 20px; height: 15px;" type="text"/> | c) Ouma <input style="width: 20px; height: 15px;" type="text"/> | | <input style="width: 20px; height: 15px;" type="text"/> |
| d) Oupa <input style="width: 20px; height: 15px;" type="text"/> | e) Tannie <input style="width: 20px; height: 15px;" type="text"/> | f) Oom <input style="width: 20px; height: 15px;" type="text"/> | | |
| g) Wettige Voog <input style="width: 20px; height: 15px;" type="text"/> | | | | |

*Slegs vir
Kantoor
Gebruik*

FAMILIE GESONDHEIDS GESKIEDENIS**Instruksies:**

Die volgende inligting is belangrik ten opsigte van u familie se gesondheidsgeskiedenis. Voltooi asseblief the volgende vrae deur 'n kruisie (x) langsaaan die toepaslike antwoord te maak, of die antwoord in te skryf.

- 12 Is u al ooit ingelig dat u Diabetes (suikersiekte) het?
a) Ja 1 b) Nee 2 14
- 13 Ly u natuurlike/biologiese moeder, vader, suster of broer aan:
Diabetes
a) Ja 1 b) Nee 2 15
Insulien Weerstand
a) Ja 1 b) Nee 2 16
Glucose Intoleransie
a) Ja 1 b) Nee 2 17
- 14 Ly u kind of enige van u ander kinders aan, of is hulle al ooit behandel vir:
Diabetes
a) Ja 1 b) Nee 2 18
Insulien Weerstand
a) Ja 1 b) Nee 2 19
Glucose Intoleransie
a) Ja 1 b) Nee 2 20
- 15 Ly u man/vrou aan, of is hy/sy al ooit behandel vir:
Diabetes
a) Ja 1 b) Nee 2 21
Insulien Weerstand
a) Ja 1 b) Nee 2 22
Glucose Intoleransie
a) Ja 1 b) Nee 2 23
- 16 Het enige van u uitgebreide familie (Tannies, Ooms, Oupas of Oumas) al ooit gely aan Diabetes?
a) Ja 1 b) Nee 2 24
- 17 Het enige van u natuurlike ouers aan 'n hartaanval beswyk voordat hulle 60

jaar oud geword het (indien u ouers jonger as 60 is, mark Nee)

a) Ja, een van hulle 1

b) Ja, altwee van hulle 2

25

c) Nee 3

d) Onseker 4

18 Het u dokter u al ooit behandel vir, of gediagnoseer met:

Hart Probleme

a) Ja 1

b) Nee 2

26

Hypertensie

a) Ja 1

b) Nee 2

27

Hoe Cholesterol

a) Ja 1

b) Nee 2

28

19 Ly u natuurlike/biologiese moeder, vader, susters of broers aan, of is hulle ooit behandel vir:

Hart Probleme

a) Ja 1

b) Nee 2

29

Hypertensie

a) Ja 1

b) Nee 2

30

Hoe Cholesterol

a) Ja 1

b) Nee 2

31

20 Ly u kind of enige van sy/haar susters of broers aan, of is hulle al ooit behandel vir:

Hart Probleme

a) Ja 1

b) Nee 2

32

Hypertensie

a) Ja 1

b) Nee 2

33

Hoe Cholesterol

a) Ja 1

b) Nee 2

34

21 Ly u man/vrou aan, of is hy/sy al ooit behandel vir:

Hart Probleme

a) Ja 1

b) Nee 2

35

Hypertensie

a) Ja 1

b) Nee 2

36

Hoe Cholesterol

a) Ja 1

b) Nee 2

37

22 Wat was u kind se gewig by geboorte?

.

38

- 23 Hoe kom u familie op 'n tipiese dag GEWOONLIK oor die weg? (Merk slegs een)
- a) Stap 1 b) Fiets 2 c) Motorcycle 3 39
- d) Motor 4 e) Vragmotor 5 f) Bus 6
- g) Trein 7
- 24 Op 'n gewone skooldag, hoeveel ure kyk u kind Televisie?
- a) Hy/Sy kyk nie TV op skooldae nie 0 40
- b) Hy/Sy kyk TV vir ure per dag.

Voeding

- 25 Eet u kind/familie sommige kos wat baie vesel bevat, byvoorbeeld volgraan brood, graankos, vars vrugte, of groente?
- a) Ja 1 b) Nee 2 41
- 26 Eet u kind/familie elke dag kosse wat baie cholesterol of vet bevat, byvoorbeeld vetterige vleis, kaas, gebraaide kos, of eiers?
- a) Ja 1 b) Nee 2 42
- 27 Eet u kind sy/haar maaltye of gereelde tye elke dag?
- a) Ja 1 b) Nee 2 43
- 28 Hoeveel dae per week nuttig (eet) u kind 'n:
- 1 Ontbyt?**
- a) 1 1 b) 2 2 c) 3 3 d) 4 4 44
- e) 5 5 f) 6 6 g) 7 7
- 2 Middagete?**
- a) 1 1 b) 2 2 c) 3 3 d) 4 4 45
- e) 5 5 f) 6 6 g) 7 7
- 3 Aandete?**
- a) 1 1 b) 2 2 c) 3 3 d) 4 4 46
- e) 5 5 f) 6 6 g) 7 7
- 29 Hoe sou u u kind se eetlus beskryf?
- a) Goed 1 b) Redelik 2 c) Swak 3 47

Socio-eonomiese Besonderhede

30 Watter tipe was/ ablusiegeriewe het u tuis?

a) Binnenshuise Spoelsisteem 1

b) Buite-huise Spoelsisteem 2

48

c) Buitenshuise Emmerstelsel 3

d) Binnenshuise Emmerstelsel 4

31 Ontvang u kind enige sakgeld?

a) Ja 1

b) Nee 2

49

32 Indien u Ja op (31) geantwoord het, hoeveel geld ontvang hy/sy GEWOONLIK?

R

50

Sielkunde

33 Het u kind die afgelope jaar enige persoonlike verlies of ongeluk ervaar wat 'n ernstige invloed op sy/haar lewe gehad het?

(Byvoorbeeld, dood of ongeskiktheid van naasbestaande of vriend)

a) Ja 1

b) Nee 2

51

Baie Dankie vir u Deelname aan Hierdie Vraelys

Indien u besluit om nie aan hierdie ondersoek deel te neem nie, wat is u rede(s) vir u onbetrokkenheid?

52

Annex 10: Simple Logistic Regression Analyses for the Respective Risk Factors Associated with Overweight and Obesity

Regression Analyses for Overweight

| Food Item | Unadjusted | | | Adjusted For Age | | |
|-------------|------------|-------------|---------|------------------|-------------|---------|
| | Odds Ratio | 95% CI | P-value | Odds Ratio | 95% CI | P-value |
| Soft drinks | 0.9 | 0.76 - 1.18 | 0.357 | 0.94 | 0.76 - 1.18 | 0.615 |
| Tea | 0.79 | 0.62 - 1.02 | 0.074 | 0.86 | 0.67 - 1.10 | 0.231 |
| Coffee | 0.86 | 0.69 - 1.06 | 0.154 | 0.87 | 0.70 - 1.08 | 0.202 |
| Squash | 0.87 | 0.71 - 1.08 | 0.218 | 0.9 | 0.73 - 1.12 | 0.347 |
| Sweets | 0.92 | 0.79 - 1.07 | 0.275 | 0.86 | 0.73 - 1.02 | 0.078 |
| Lollypops | 0.91 | 0.77 - 1.09 | 0.305 | 0.88 | 0.74 - 1.05 | 0.152 |
| Chocolate | 0.98 | 0.82 - 1.17 | 0.81 | 0.95 | 0.79 - 1.15 | 0.625 |
| Fast foods | 0.86 | 0.67 - 1.09 | 0.214 | 0.82 | 0.64 - 1.06 | 0.129 |
| Pies | 0.88 | 0.67 - 1.15 | 0.338 | 0.87 | 0.66 - 1.16 | 0.352 |
| Pizza | 0.7 | 0.44 - 1.10 | 0.122 | 0.73 | 0.46 - 1.17 | 0.193 |
| Hotchips | 0.84 | 0.65 - 1.08 | 0.176 | 0.85 | 0.65 - 1.11 | 0.22 |
| Pork | 0.94 | 0.71 - 1.24 | 0.654 | 0.99 | 0.75 - 1.31 | 0.952 |
| Eggs | 0.95 | 0.78 - 1.16 | 0.613 | 0.94 | 0.771.15 | 0.537 |
| Beer | 1.13 | 0.393.24 | 0.82 | 0.79 | 0.262.34 | 0.666 |

Regression Analyses for Obesity

| Food Item | Unadjusted | | | Adjusted For Age | | |
|-------------|------------|-------------|---------|------------------|-------------|---------|
| | Odds Ratio | 95% CI | P-value | Odds Ratio | 95% CI | P-value |
| Soft drinks | 1.31 | 0.99 - 1.71 | 0.051 | 1.31 | 0.99 - 1.72 | 0.055 |
| Tea | 0.76 | 0.48 - 1.21 | 0.253 | 0.74 | 0.46 - 1.12 | 0.225 |
| Coffee | 1.19 | 0.91 - 1.56 | 0.207 | 1.19 | 0.91 - 1.56 | 0.212 |
| Squash | 1.08 | 0.81 - 1.46 | 0.591 | 1.08 | 0.80 - 1.45 | 0.602 |
| Sweets | 1 | 0.77 - 1.29 | 0.907 | 1 | 0.77 - 1.30 | 0.993 |
| Lollypops | 0.82 | 0.60 - 1.14 | 0.245 | 0.83 | 0.59 - 1.15 | 0.251 |
| Chocolate | 0.83 | 0.57 - 1.20 | 0.328 | 0.83 | 0.57 - 1.21 | 0.337 |
| Fast foods | 1.05 | 0.76 - 1.47 | 0.756 | 1.06 | 0.76 - 1.47 | 0.748 |
| Pies | 0.33 | 0.120 - .87 | 0.026 | 0.33 | 0.12 - 0.88 | 0.026 |
| Pizza | 0.87 | 0.47 - 1.58 | 0.64 | 0.86 | 0.47 - 1.57 | 0.619 |
| Hotchips | 1.11 | 0.80 - 1.54 | 0.52 | 1.11 | 0.80 - 1.54 | 0.533 |
| Pork | 0.91 | 0.55 - 1.48 | 0.693 | 0.9 | 0.55 - 1.48 | 0.67 |
| Eggs | 0.74 | 0.49 - 1.11 | 0.146 | 0.74 | 0.49 - 1.11 | 0.148 |



