PREVALENCE AND ASSOCIATED HEALTH RISK FACTORS OF OVERWEIGHT AND OBESITY AMONG EDUCATORS IN NKOMAZI LOCAL MUNICIPALITY, EHLANZENI DISTRICT, MPUMALANGA PROVINCE

By

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A mini-dissertation submitted in partial fulfilment of the requirements for the degree of Master in Public Health (MPH) at the School of Health Sciences at the University of Venda

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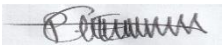
DECLARATION

I **Chambale Prudence (11627569),** hereby declare that the mini-dissertation **titled "Prevalence and associated health risk factors of overweight and obesity among educators in Nkomazi Local Municipality, Ehlanzeni District, Mpumalanga Province"** for the Master of Public Health degree at the University of Venda hereby submitted by me, has not been submitted previously for a degree at this or any other University, that is my own work in design and in execution, and that all reference material contained therein has been duly acknowledged.

Signature  **Date** 05 April 2022

DEDICATION

This mini-dissertation is lovingly dedicated to my respective deceased parents, Isaac Mfana Chambale and Margareth Thoko Nyambi-Chambale who had always been my constant source of inspiration. Thank you for your teachings which gave me the drive and determination to tackle this project with passion, courage and enthusiast. To my late nephew, Mkhuleko Gift Mhlanga, thank you for the wonderful memories. To my supportive siblings, Precious, Bheki, Nkhosinathi, Gift, Confidence and Prosperity, thank you for always having my back. To my beautiful daughter, Lerato Chambale, I leave these words with you “never give up on your dreams no matter how unrealistic they seem”. Lastly, I dedicate this project to my spiritual folks Bishop C. Khoza, Bishop B. Khoza and Pastor T. Mashabela. Thank you for your amazing support in difficult times.

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ABSTRACT

Background: Overweight and obesity are global public health problems and the two terms are often used interchangeably. According to the World Health Organization the prevalence of obesity has nearly doubled over the past twenty years. World population estimates indicate that about half a billion people who are over 20 years are either overweight or obese and thus almost 2.8 million people die per year due to complications and conditions caused by excessive fat.

Aim: The aim of the study was to investigate the prevalence and associated health risk factors of overweight and obesity among educators in selected schools in Nkomazi Municipality.

Methodology: A quantitative cross-sectional design was used. The population of this study included all teachers in the Nkomazi Municipality. Three circuits were randomly selected, and all the nineteen schools within the three circuits were included in the study and simple random sampling was used to select 315 teachers from 1,010 teachers. A modified World Health Organization stepwise questionnaire for non-communicable diseases latest version was used to collect data regarding demographic characteristics, and lifestyle risk factors. A Seca weighing scale was used to measure respondents' weight, stadiometer was used to measure height, GUlick anthropometric tape was used to measure girths, an automatic sphygmomanometer was used to measure blood pressure and an accu-chek Instant machine was used to measure glucose level. The Statistical Package of Social Sciences version 26.0 was used to analyse data. The Chi-square test was used to determine the association between obesity and risk factors. Charts and graphs were used to present the results of the study.

Results: The prevalence of overweight was 33.9%, obesity class I was at 21.4%, obesity class II was at 6.4% and obesity class III was at 3.1%. Moreover, only 33.2% were found to be normal. The findings also highlighted that 40.3% of the participants did not participate in moderate physical activity, 60.3% agreed to snacking between meals while 49.5% reported that they spend more than 10 hours seated on a daily basis. The findings also revealed that 29.5% were pre-hypertensive while 41.4% were at a high risk of developing diabetes mellitus. Statistically, significant difference was evident between family history and increased BMI and WHR (P=0.001 and P=0.026).

Conclusion: The findings take a lead in concluding that participants had a high prevalence rate of overweight and obesity due to negative lifestyle habits. The study therefore recommends that education authorities must ensure that educators participate in moderate physical activity and consume healthy foods.

Keywords: Educators, exercise, nutrition, obesity, overweight, prevalence, risk factors.

LIST OF ABBREVIATIONS AND ACRONYMS

ACSM	American college of Sport Medicine
AIDS	Acquired immunodeficiency syndrome
BGL	Blood glucose level
BIA	Bio Impendence Analysis
BMI	Body mass index
BP	Blood pressure
CDC	Centers for Disease Control and Prevention
CVD	Cardiovascular diseases
DALY	Disability-adjusted life years
DBP	Diastolic blood pressure
DoH	Department of Health
FBDGs	Food Based Dietary Guidelines
GBD	Global Burden of Disease
IPAQ	International Physical Activity Questionnaire
HBP	High blood pressure
HC	Hip Circumference
HDL	High density lipoprotein
HIV	Human immunodeficiency virus
KG	Kilograms
KG/M²	Kilograms per meter squared
KZN	KwaZulu-Natal
LDL	Low density lipoprotein
LMICs	Low and middle income countries
MmHg	Millimetres of mercury
NHNES	National Health and Nutrition Examination Survey
NCDs	Non-communicable diseases
NCD-RisC	Non Communicable Disease Risk Factor Collaboration
PA	Physical Activity
PPE	Personal Protective Equipment

SA	South Africa
SAMRC	South African Medical Research Council
SBP	Systolic blood pressure
SBRN	Sedentary Behaviour Research Network
SES	Socio-Economic Status
SHDC	School Higher Degree Committee
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
UHDC	Television
TV	University Higher Degree Committee
UNIVEN	University of Venda
USA	United States of America
WC	Waist Circumference
WMA	World Medical Association
WHO	World Health Organization
WHR	Waist to Hip Ratio

TABLE OF CONTENT

Contents page no

LIST OF FIGURES

LIST OF TABLES

SYMBOLS

<	Less than
>	Greater than
≤	Less or equal to
≥	Greater or equal to
~	Approximately
$	United States Dollar

CHAPTER 1
INTRODUCTION

1.1 Background of the study

Overweight and obesity are major clinical concerns worldwide (Habbab & Bhutta, 2020). In addition, the WHO (2018) states that the epidemic of obesity continues to rise globally in recent decades. In 2015, it was estimated that two billion people worldwide are either obese or overweight, that is approximately 30% of the world population (WHO, 2016). In addition, more than 1.9 billion adults aged 18 years and older were found to be overweight, while over 650 million adults were found to be obese (Lim, Xue & Wang, 2020).

In 2016, more than 1.9 billion adults aged 18 years and older were overweight whilst more than 650 million were obese (WHO, 2020). Besides, projection shows that 38% of the world`s population will be overweight and 20% will be obese in 2030 (Malik, Willet & Hu, 2017). Worldwide, more women are obese or overweight as compared to men. Also, 39% of adults aged 18 years and over (39% of men and 40% of women) are overweight (WHO, 2017). Overall, about 13% of the world's adult populations (11% of men and 15% of women) were obese in 2016 (Lim, Xue & Wang, 2020). In addition, an estimated 41 million children under the age of 5 years are overweight or obese (WHO, 2017). A longitudinal study by WHO (2016) on obesity indicate that between 1975 and 2016, the prevalence of obesity had nearly tripled over the past 41 years.

Obesity and overweight are public health problems all over the world. In Europe, it is estimated that 20% of adults are overweight or obese (Branca, Nikogosian & Lobstein, 2017). In 2017, it was also estimated in the European Union that overweight affects 30-70% and obesity affects 10-30% of adults (WHO, 2018). Furthermore, the Centers for Disease Control and Prevention (CDC) in the United States of America (USA) indicate that 70% of adults are overweight or obese, more men (38.7%) are considered to be overweight, as compared to 26.5% of women. However, more women are obese as compared to men (CDC, 2017).

Although obesity and overweight have been considered a developed world phenomenon, developing countries are also affected severely by these public health burdens (Oliveira & Moreira, 2015). Even though data on the prevalence of overweight and obesity is hard to find in Africa, previous prevalence studies confirm that it exists (Chukwuonye, Chuku & John, 2013; Micklesfield, Lambert, Hume, Chantler, Pienaar, Dickie, Puoane & Goedecke, 2013).

Studies conducted in Sub-Saharan Africa show that overweight and obesity rates are increasing in all African regions, with the Southern African region being the most affected (Stevens, Singh, Lu & Danaei, 2017). The rate of overweight and obesity is also higher among women than among men, in urban areas compared to rural areas (Agyemanga, Boatemaa, Frempong & Aikins, 2015).

Oliveira and Moreira (2015) observed that in South Africa (SA) and other developing countries, obesity is one of the top five risk factors for premature death. In South Africa, it is estimated that the prevalence of obesity is increasing (Statistics South Africa, 2017) because more women (70%) are either obese or overweight while only a third (30%) are considered as normal. However, only 40% of men are considered as overweight or obese while 60% are considered normal, which concurs with other countries that obesity is more prevalent among women than men. In addition, childhood obesity is also increasing, whereby more girls are found to be obese than boys (Statistics South Africa, 2017).

The prevalence of death in Africa attributable to obesity complications has increased by nearly 82% in the last five years on individuals with a BMI of more than 30kg/m^2 (Damton, Nishida & James, 2014). Moreover, the WHO (2016) has estimated that 28.3% of adults in SA are obese. This is regarded as the highest obesity rate for the African countries. Consequently, South Africa is perceived as the unhealthiest country worldwide with an average life expectancy of 63.6 years (Karlin & Weil, 2017). In addition, Biadgilign, Mgutshini and Haile (2017) revealed that 11.6 out of 100 000 obese South Africans commit suicide every year due to obesity traits while simultaneously have a 26% probability of dying from cardiovascular disease and diabetes among other lifestyle related conditions between the ages of 30 and 70. On the contrary, Owolabi, Goon and Adeniyi (2017) found that Seychelles was at the forefront at 78.3%, followed by Lesotho at 70.8%, while South Africa was ranked third in place at 68.5%.

Provincial statistics also demonstrate a high prevalence rate of obesity. In addition, Mpumalanga is one of the provinces with a higher rate of obese adults (70.8%) despite it being one of the least populated provinces in SA. Moreover, Gauteng province is ranked on top with 88.3% obese adults, followed by KwaZulu-Natal (KZN) with 77.5%. Western Cape followed closely with 77.4%. The lowest proportion was revealed in the Limpopo province, where 61.5% of adults were obese, followed by North West at 59.3% (Maimela, Alberts, Modjadji, Choma, Dikotope, Ntuli & Van Geertruyden, 2016). Similar results were found in a study conducted by Draper, Davidowitz and Goedecke (2016) whereby KZN was on a lead with 81.3% obese adults, followed by Gauteng with 81.1%.

The prevalence of overweight and obesity continues to rise drastically worldwide due to economic transitions influenced by technology and innovations (Arena, McNeil, Sagner & Hills, 2017). As a result, the dietary quality of African diets worsened and physical activity patterns were reduced (Arena *et al*., 2017). Evidence shows that the consumption of high-energy food, physical inactivity, the sedentary nature of many forms of work and means of transportation contribute to the rise of overweight and obesity (Zubery, Kimiywe & Martin, 2021). Furthermore, occupation relates to socio-economic status and lifestyle factors thus it is considered as a predicting factor for overweight and obesity (Rengma, Sen & Mondal, 2015). Alterations in dietary and physical activity (PA) patterns are the major causes of overweight and obesity, with an unequal distribution across socio-economic groups (Lobstein & Frelut, 2018). To buttress this fact, Larson, Story and Nelson (2017) reported that numerous factors play a major role in the continuous growing epidemic of obesity, which includes greater access to fast foods, large portion sizes and ubiquitous processed food. Conversely, emerging science also suggests that chemicals from foods and household products may also contribute to the escalating rise in obesity (Stevens, Singh, Lu & Danaei, 2017).

In the teacher population, poor eating habits and lack of PA have been shown to be the most frequent factors associated with obesity in different regions across the country (Oliveira & Moreira, 2015). According to Conde, Oliveira, Borges and Baraldi (2016), obesity is becoming a major concern among workers. Alterations in the working conditions of many professionals, particularly teachers contribute to the development of lifestyle-related diseases including obesity. Reis, Tzotsas and Vlahavas (2016) found that the characteristics of the school environment, including inadequate infrastructure, lack of equipment and its maintenance, insufficient human resources, number of students per class, low wages, professional devaluation and little social support are the causes of health-related problems in teachers.

Flegal, Carrol, Kit and Ogden (2017) state that overweight and obesity are linked to variety of complications. Santos and Barros (2016) also indicate that overweight and obesity epidemic pose serious and potentially detrimental health risks such as hypertension, diabetes and hyperlipidaemia which kill 41 million people each year. Moreover, obesity in the adult population has well-documented serious adverse consequences, especially as far as non-communicable diseases (NCDs), metabolic syndrome, locomotor disorders, respiratory, dermatological disorders and associated mortality are concerned (Gadalla, 2014). Similarly, Larson (2016) found that 15 million people die prematurely from a NCD between the ages of 30 and 69 years, and over 85% of these sudden deaths occur in low-and middle-income countries. Excessive body weight is directly associated with four million deaths globally, which shows that obesity is a continuum issue and is regarded as one of the life-threatening diseases

worldwide (Malnick & Knobler, 2016). Overweight and obesity among teachers are associated with discrimination in their professional and social lives, which results in low productivity (Russel, Silver & William, 2018). In addition, obesity has a considerable impact on one`s emotional and psychological wellbeing, including functional abilities and daily activities (Flegal, Carol & Ogden, 2016). Furthermore, treatment attempting to reverse obesity, such as pharmaceutical agents, weight reduction programmes, special dietary supplements and surgical procedures, are very expensive (Wolf & Colditz, 2015; Finkelstein, Trogden, Cohen & Dietz, 2016).

1.2. Problem statement

Teachers represent one of the most essential members of the society; therefore, their health takes priority. Furthermore, Cois and Day (2015) observed that obesity incidence and prevalence continues to increase drastically in rural communities. The Nkomazi Local Municipality is predominately rural and faces many public health predicaments including the high prevalence rate of overweight and obesity, which are influenced by unhealthy lifestyle practices. The researcher observed that most educators in Nkomazi travel to and from work either on public transport or their personal cars and spend a lot of time seated and marking scripts, which makes them vulnerable to obesity, as they practice a sedentary lifestyle. Hence, the researcher is concerned about this situation and became motivated to conduct this study. In addition, the Nkomazi Local Municipality in Ehlanzeni District is disadvantaged. As a result, it experiences a shortage of health care facilities, weight management experts, programs, and services to assist inhabitants in acquiring knowledge about the importance of making healthy choices and the dangers that overweight and obesity predispose them to. Ultimately, they continue to invest in businesses that promote weight gain instead of investing in facilities and infrastructures that promote weight loss and fitness. Likewise, public schools experience a shortage of exercise facilities and infrastructure to promote and encourage physical activity thus resulting in higher rates of obesity in the teacher population (Lee, Lo & Ho, 2018). Therefore, this study aimed to investigate the prevalence and associated health risk factors of overweight and obesity among educators in Nkomazi Local Municipality, Ehlanzeni District, Mpumalanga Province.

1.3. Rationale for the study

Several studies have been conducted on obesity; for example, Goon (2014); Mohlala (2017); Silva, Petroski and Souza (2017) conducted studies on obesity; however, these studies focused on the youth. A similar study was conducted on obesity among University of Venda students in Limpopo Province by Muluvhu (2015). The findings indicated that the obesity prevalence rate of 76%, 62 % of physical inactivity, stress and unhealthy dietary habits.

However, few studies have been conducted on obesity among school staff, which shows a gap in knowledge, especially in the workplace.

Furthermore, professionals have conducted few studies of this nature in Nkomazi Municipality. Phetla (2017) conducted a study on the perception of health care professionals regarding obesity in Mpumalanga province. The findings indicated that 51.9% were obese, 21.4% were overweight and only 24.3% were of normal body weight. This was regarded as a high overweight and obesity prevalence rate. However, there is no study that has been carried out to investigate the prevalence and associated risk factors of overweight and obesity amongst educators. Therefore, it was vital to fill the gap in literature by conducting this study, to investigate the prevalence and associated health risk factors of overweight and obesity among educators in Nkomazi Municipality, Ehlanzeni District Mpumalanga Province.

1.4. Significance of the study

It was conjured that the findings that are obtained from the present study might add to the existing body of knowledge. Furthermore, insights from the study may also help policymakers develop policies specific to obesity and overweight for the Department of Education and other local government as well as the health worker`s organisations and other health care providers. The data gathered may also be used to design interventions to prevent the on-going trend of overweight and obesity for teachers. Lastly, insights from the current study may also be used by the Department of Health to implement health and wellness campaigns and other measures to address the risks associated with obesity, as interventions to reverse the anticipated trends countrywide.

1.5 Purpose and Objectives

1.5.1 Purpose

The purpose of the study was to investigate the prevalence of obesity and associated with health risk factors among educators in Nkomazi Municipality, Ehlanzeni District, Mpumalanga Province.

1.5.2 Objectives

The objectives of the study are as follows:

- To assess anthropometric status Body Mass Index (BMI), percentage body fat and waist to hip ratio (WHR) of educators in Nkomazi local Municipality, Ehlanzeni District, Mpumalanga Province.

- To identify lifestyle risk factors (smoking status, alcohol consumption, nutritional practices and physical activity practices) associated with overweight and obesity among educators in Nkomazi Local Municipality, Ehlanzeni District, Mpumalanga Province.
- To assess the blood pressure and glucose level among educators in Nkomazi Local Municipality, Ehlanzeni District, Mpumalanga Province.
- To correlate anthropometric status with lifestyle risk factors associated with overweight and obesity among educators in Nkomazi Local Municipality, Ehlanzeni District, Mpumalanga Province.

1.6. Definition of key terms

The following conceptual and operational terms were defined as they were used in the study.

Educator is a professional who is trained to provide instruction and teaching methods in the field of education to learners (Cameron, 2016). In this study, educator is defined as participants who took part in the study.

Obesity is a medical condition whereby excessive body fats have been accumulated and stored, which may negatively impact health (WHO, 2016). In this study, obesity is defined as a BMI of 30.0 up to greater than 40 Kg/ m^2.

Overweight is an excessive amount of body fat that may come from muscles, bone or water, resulting in a body weight greater than what is considered normal for a given height (Thomas, Nelson & Silverman, 2015; WHO, 2015). In this study, overweight is defined as a BMI of 25.0 to 29.9 Kg/m^2.

Prevalence is the total number of people with a specific disease at a given time (Medical Dictionary, 2015).

In this study, prevalence is defined as the total number of people who will be obese at the time of the study.

Risk factor is a factor which decisively increases the likelihood of developing something and affects the nature or outcome of that something (Popkin, 2016). In this study, risk factors are defined as the factors that increase the chances of being overweight or obese.

1.7 Arrangement of chapters

The study is divided into six chapters as follows:

Chapter One: Introduction and background

This chapter provides a brief introduction and background of the study. The problem statement, rationale for the study, significance of the study, objectives and definition of terms are presented in this chapter.

Chapter Two: **Literature review**

The chapter provides a review of previous studies used to motivate the study. It highlights the overview of overweight and obesity prevalence internationally, nationally and provincially. The factors associated with overweight and obesity which include physical activity practices, nutritional practices, smoking status and alcohol consumption. This chapter also outlines the anthropometric, blood pressure and glucose measurements.

Chapter Three: Research methodology

This chapter outlines the research approaches and methods which were utilized in the study. It briefly explains the study design, sampling procedure, data gathering, and data analysis methods.

Chapter Four: Results.

The study findings are outlined in this chapter. The findings are presented in tables, graphs and charts.

Chapter Five: Discussion of the results

The research findings are discussed and compared with existing literature related to the study. The discussion was focused on overweight and obesity prevalence, associated risk factors, anthropometric, blood pressure and glucose measurements

Chapter Six: **Conclusion and recommendations**

This chapter provides the conclusions and recommendations of the study.

1.8 Chapter Summary

This chapter provided the background and introductory part of the study. It covered the prevalence of overweight and obesity in Africa and in European countries. It also covered the problem statement, objectives of the study, rationale for the study, significance of the study and definition of key terms.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter aims at discussing the epidemiological features of obesity based on relevant international and national literature which includes the prevalence, methods of assessing obesity, risk factors, complications associated with the condition as well as management and prevention of obesity. Literature search strategies were developed around four groups of keywords: overweight, obesity, educators and prevalence. Furthermore, the title of the study was also used to search for recent literature. The electronic databases that were used to search for literature are google scholar, science direct, Ebscohost, PubMed and SPORT Discus. This includes a compilation of peer reviewed journals, book chapters, policy briefs and studies listed in the CDC, WHO guidelines and broader web searches to retrieve emerging literature. Studies were considered eligible for inclusion if they examined both males and females. Participants were aged 18 years and older at baseline. Studies had to be published between 2010-2021 and written in English language. Studies were excluded if they focused on clinical cohorts, were commentaries, conference proceedings and intervention studies.

2.2 Prevalence of overweight and obesity

The prevalence of overweight and obesity covered in this literature includes the global, regional, national and provincial general perspectives including the prevalence among educators which is the focus on this study.

2.2.1 Global perspective

The prevalence of overweight and obesity has risen significantly over the past three decades worldwide, with marked variations across countries in the levels and trends in obese individuals with distinct regional patterns (Bluher, 2019). Moreover, obesity is fast becoming a growing threat to human health in developed and developing nations and it is regarded as a major public health problem (WHO, 2016). According to the Global Burden of Diseases (2017), more than 4.7% million people died prematurely in year 2017 as a result of obesity. This was approximately four times the number that died due to vehicle accidents and almost five times the number of those who died from human immunodeficiency virus (HIV) and/or acquired immunodeficiency syndrome (AIDS) in 2017.

The international patterns of obesity prevalence vary noticeably across countries. In developing countries, the proportion of those subjective to obesity in the population is high

and it is estimated to further increase (Fleming, Robinson, Thomson, Graetz & Margono, 2015). Furthermore, many low and middle income countries (LMICs) have transitioned from a chronic energy deficient state to one of over nutrition (Malick, Willet & Hu, 2015). However, in other developing countries, these extremes of nutrition can coexist within the same region or country (Popkin, 2016). In comparison, developed countries have had a marked increase in the incidence of obesity (WHO, 2016). The prevalence of obesity differs across regions (Ng *et al*., 2013). England has some of the worst trends and figures in obesity (67% of men and 60% of women) compared with the rest of the Europe (CDC, 2015). In most European countries, the trend has increased from 10% to 40% in the last ten years, whereas in England the prevalence has more than doubled by 65% in men and 25% in women (CDC, 2015).

The WHO (2017) stated that the prevalence of obesity in adults has been increasing in all countries. The worldwide prevalence of obesity nearly tripled between 1975 and 2016 as it rose from 4% to about 18% (Lim, Xue & Wang, 2020). In 2016, more than 1.9 billion adults aged 18 years and older were overweight (WHO, 2017). Similarly, Chooi, Ding and Magkos (2019) found that 79% of adults aged 18 years and over were overweight (39% men and 40% women). Overall, about 13% of the world's adult population (11% of men and 15% of women) were obese in 2016 (Arena *et al*., 2017).

The WHO (2015) estimated the global prevalence of obesity and overweight in various countries. The Pacific Islands, east of Australia, was on top of the list of the countries with the highest percentage of their populations obese (WHO, 2015). American Samoa, found South of Samoa, tops the chart, with 75 percent of the population reported as obese. In Europe, the highest prevalence of greater than 25% were reported in countries like Poland, Czech Republic, Portugal, Romania and Albania (WHO, 2015). The United Kingdom (UK) had almost 27% obesity rate whereas France, Italy and Sweden fared considerably better with a less than 10% rate of obesity (CDC, 2015). In the United States, a third of the population was found to be obese though in Canada the prevalence of obesity was not as high as in the United States, of which only 25% of adults were obese by 2008 (Bluher, 2019).

In terms of gender in Europe, Eastern Mediterranean and America, 23%, 24% and 29% of men respectively were found to be obese (Kirunda, Fadnes, Wamani, Van den Broeck & Tyllesskar, 2015). However, Ali, Almobarak, Awadalla, Elmadhoun and Ahmed (2017) state that women have double the obesity of men in Africa (54.3%), Eastern Mediterranean (43.8%) and South East Asia (64.4%).

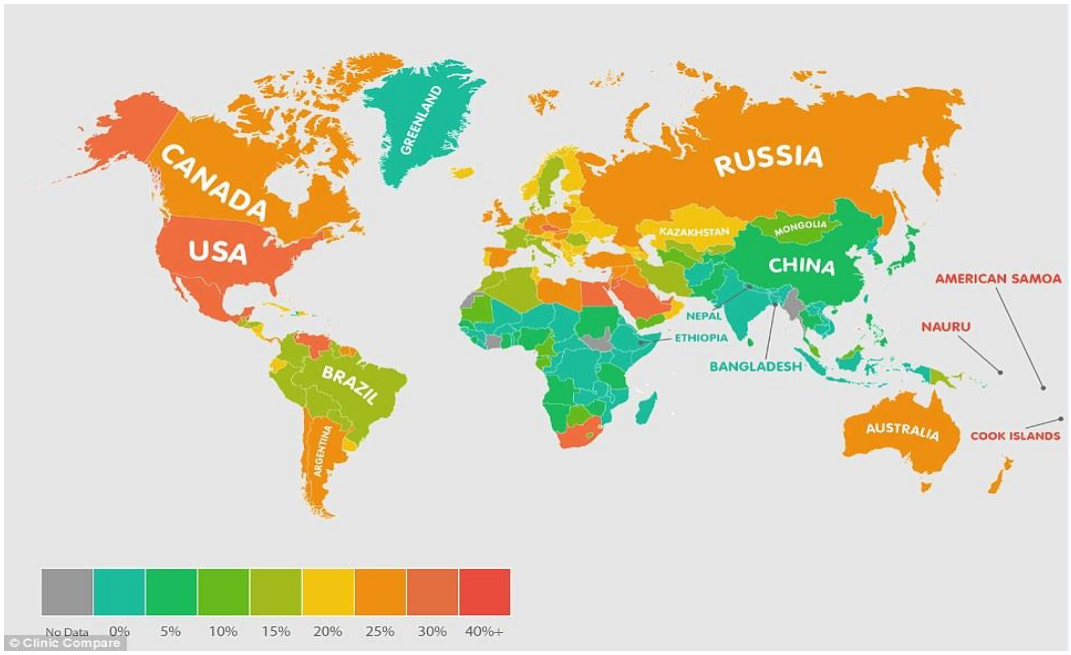

Figure 2.1 Map indicating Global statistics of obesity (Kirunda et al., 2015)

Most of Africa and South Asia are shown with low levels of obesity, while most of the USA, Europe, Australia, and the Middle East are shown in orange (see Figure 2.1 above), indicating high levels of obesity (WHO, 2015).

2.2.2 Regional perspective

In Africa, similar rising trends of obesity are observed despite the continent battling with under nutrition (Bluher, 2019). A study by Non-Communicable Diseases Risk Factor Collaboration (NCD-RisC) team revealed that from 1980 to 2014, the age-standardized mean BMI in Africa increased from 21.0 kg/m2 for men and 21.9 kg/m2 for women to 23.0 kg/m2 and 24.9 kg/m2, respectively (NCD-RisC, 2017). The WHO (2016) estimates that overweight and obesity have increased drastically in sub-Saharan Africa (SSA). Among Sub-Saharan African men in 2013, Equatorial Guinea had the highest prevalence of obesity (25%) and Uganda the least (1.7 %) whereas among women, South Africa had the highest (42%) and Ethiopia the least prevalence (1.8 %) (WHO, 2016).

According to a study by Ajayi (2016), the prevalence of overweight and obese (combined) was 46 %, 48 %, 68 %, 75 % and 85 % in rural Uganda, Peri-urban Uganda, Nigeria, Tanzania and SA respectively. In terms of gender, findings are almost unanimous in Africa in revealing women being affected with obesity more than their male counterparts. Moreover, in another study among adults 18 years and above across 53 African countries in 2014, the age-standardized mean BMI of 23.0 kg/m2 (22.7–23.3) was recorded for men relative to 24.9

kg/m2 (24.6–25.1) for women (NCD-RisC, 2017). Furthermore, in Ghana, it is reported that females were about eight times more likely to be overweight/obese than males (Flegal, Carroll & Ogden, 2016). Similarly, Owolabi, Goon, Adeniyi, Adedokun and Seekoe, (2017) found that obesity prevalence was higher among South African women (62,2%) compared with men (25,1%).

According to a study conducted by Harvard School of Public Health, the prevalence of obesity is also on the rise in the Southern African Development Community, which previously was not the case as the countries were struck by undernutrition. For Example, the Democratic Republic of Congo in 2008 was having a BMI of 19.9% in men which were the lowest in the world (Flegal *et al*., 2017). According to WHO (2016), South Africa had the highest prevalence of obesity of 28.3% as compared to the neighbouring countries such as Namibia (17.2%), Lesotho (16.6%) and Zimbabwe (15.5%) (Table 2.1).

Table 2.1 Levels of obesity rates regionally (WHO, 2016)

Country	Obesity rate
South Africa	28.3%
Botswana	18.9%
Namibia	17.2%
Lesotho	16.6%
Eswatini	16.5%
Zimbabwe	15.5%
Gabon	15.0%
Seychelles	14.0%
Djibouti	13.5%
Mauritania	12.7%

A study that was conducted in Tanzania revealed that the more the health care professionals are obese, the more it affects the way they give advice to their patients about healthy lifestyle (Agyemang *et al*., 2016). Other dynamics of obesity worth mentioning includes the rural/urban prevalence. Studies have agreed almost unanimously to a higher urban prevalence compared with rural, higher rates in females relative to men and an increasing trend of obesity with age, peaking before age 70 years (Rengma, Sen & Mondal, 2015). A study in Mozambique saw 39.4% of women in urban areas being overweight/obese compare to 9.2% in rural areas. This pattern did not change in men as 21.5% in urban were overweight/obese compared to 7.0%

in rural settings (Amugsi, Dimbuene, Mberu, Muthuri & Ezeh, 2017). A systematic review revealed a higher prevalence of overweight (27.2% vs. 16.7%) and obesity (20.6% vs. 8.0%) for urban than rural dwellers respectively (Ofori-Asenso, 2016).

2.2.3 National perspective (South Africa)

According to the South African Medical Research Council (SAMRC, 2017), excess body weight is a huge continuum problem in South Africa. In addition, South Africa is drowning from obesity according to findings. (SAMRC, 2017). Moreover, the study findings revealed that almost four million deaths globally occurred because of obesity in 2015. In addition, almost half of those deaths (40%) occurred in people who were classified as overweight and not obese. Furthermore, these findings demonstrate that obesity is indeed a continuum detrimental issue and that even moderately overweight is as dangerous as obesity (Adair & Lopez, 2020). Excess body weight is a massive problem in adults and the paediatric population (Chooi, Ding & Magkos, 2019). Moreover, 13% of South African children are either overweight or obese, higher than the global average of 5% (Pienaar, 2015). Children who are obese at an early age have high chances of being obese adults and slim chances of being lean when they grow into adults (Schutten, Joosten, de Borst & Bakker, 2018). In obese children, the numbers of fat cells in their bodies increase and remain the same when they get older while in lean children the number of fat cells is lower thus giving them much better chances of being lean as they grow older (WHO, 2017).

2.2.4 The prevalence of obesity among educators

The prevalence of obesity has also increased among teachers (Monica & John, 2018). Moreover, Lee, Hairi and Moy (2017) conducted a study on the prevalence of obesity in India, revealing that 46.1% of the participants were overweight while 10.8% were obese. Similarly, Mini, Sarma, Priya and Thankappan (2020) revealed that 43.2% of teachers were class 1 obese, 20.4 were class 2 obese, and 6.6% were class 3 obese. This was considered a significant health challenge in the teacher population. Moreover, this high rise in obesity among teachers who are ought to be aware of harms of obesity, and be role-models to students is worrisome. Even though the prevalence of obesity was found to be higher in women on general population, higher prevalence in men in this study was attributed to that women form a higher educated group (Lee, Hairi & Moy, 2017). Consequently, comparative studies conducted with other profession groups and with the general populace are necessitated.

Rocha (2015) revealed that the prevalence was significantly higher among male teachers (58.2%), married or cohabitating subjects (49.1%), whites and mulattoes (87.6%), teachers

with an income >$ 2,002.00 and a permanent contract (45.9%), and subjects who did not consume fruits or vegetables (49.1%). After multivariate analysis, only gender and consumption of fruits and vegetables remained significantly associated with overweight/obesity among teachers (Monica & John, 2018). These findings promote debate on the need for actions designed to encourage the teacher population's adoption of an active lifestyle. The prevalence rates of overweight and obesity were 41.2% and 17.9%, respectively. The prevalence of obesity was significantly higher in kindergarten teachers ($p < 0.001$) compared to national Micro census data. Only 44.6% of teachers could identify overweight children correctly.

Similarly, Liu, Xu, Liu, Rao, Reis, Sharma, Yuan, Chen and Zhao (2018) stated that about 34% of the women were overweight while 27% were found to be obese with 17.8% centrally-obese. However, the WHR ratio classified majority (57%) of the women as low risk. There was a strong positive correlation between BMI and WHR with age. This means that as women aged, both BMI and WHR increased. The prevalence of obesity for a woman above 35 years was about four times higher than the prevalence among the younger age group (<25 years) and two times higher than that of the middle age group (26-35 years). This revealed 41.2% and 19.7% of teachers who were overweight or obese (Al-Isa, 2016).

2.3. Methods of assessing obesity

Various methods are used to assess overweight and obesity. This includes body composition analysis, bioelectrical impendence analysis and hydrostatic weighing. However, this study used the body composition analysis method for assessment of overweight and obesity among educators.

2.3.1 Body composition analysis

Body composition analysis is a physical test that measures the proportion of the various components of a person`s body (Lohman, Going & Wang, 2015). The human body is comprised of water, protein, fat, and minerals but for most purposes, it is the level of fat compared to lean mass that is of interest. In general, most body composition analysis tests measure the ratio of fat to lean tissue (Schubert, Seay, Spain, Clarke & Taylor, 2019). Body fat, or adipose tissue, has chemical and physical properties that allow for several analytical methods, each with its own advantages and limitations (Utczás, Tróznai, Pálinkás, Kalabiska & Petridis, 2020). The most common form of body composition analysis is the body mass index, skinfold calliper testing, and circumferences which are referred to as anthropometry (WHO, 2016). This is the commonly used method because it is a safe, portable, non-invasive and inexpensive method of determining body composition (ACSMs, 2014).

2.3.2 Bioelectrical impendence analysis

Bio-electrical Impedance Analysis or Bio Impedance Analysis (BIA) is a method of assessing one`s body composition: the measurement of body fat in relation to lean body mass (Lohman, Going & Wang). It is an integral part of a health and nutrition assessment. Furthermore, research has shown that body composition is directly related to health (De Lorenzo, Romano, Di Renzo, Di Lorenzo, Cenname & Gualtieri, 2020). A normal balance of body fat is associated with good health and longevity (Di Lorenzo et al., 2020). Excess fat in relation to lean body mass: altered body composition, can greatly increase your risks for cardiovascular disease, diabetes, and more (Utczás *et al.*, 2020). Also, BIA allows for early detection of an improper balance in one`s body composition, which fosters earlier intervention and prevention (Lusaski, 2017). In addition, it also provides a measurement of fluid and body mass that can be a critical assessment tool for an individual`s current state of health (Bluher, 2020).

Some of the limitations of these methods are that the equipment is relatively expensive and, because bioelectrical impedance measures the body`s water resistance to the current, the measurement is affected by the body`s hydration status, body temperature, food intake, menstrual cycle stage and time of the day (Bluher, 2020; Lohman, Going & Wang, 2015). It therefore, requires well-controlled conditions to get accurate and reliable measurements (Ward, 2019). In recent years, the examination of human body composition has grown in its use and importance in medicine, physiology, fitness assessment, sports, nutrition, and public health (Lohman, Milliken & American College of Sports Medicine, 2019).

2.3.3 Hydrostatic weighing (densitometry)

According to Lohman, Milliken and American College of Sports Medicine (2019), densitometry is assessing body composition by measuring the density of the entire body. Density is expressed as mass per unit volume and usually is obtained through hydrostatic or underwater weighing hence it is also referred to as “underwater weighing”. It is often regarded as the gold standard of body composition analysis (Schubert *et al*., 2019). However, this method involves the immersion of a subject in an underwater tank. It is highly technical, time consuming and requires considerable subject`s co-operation (ACSMs, 2014). In recent years, even more complex and expensive methods such as dual energy x-ray absorptiometry scanning and magnetic resonance imaging are recognized amongst researchers as accurate body composition assessment methods (Utczás, 2020).

2.4 Risk factors associated with obesity and overweight

Although there are genetic, behavioural and hormonal influences on body weight, obesity occurs when one consumes more calories than he/she burns through exercise and normal

daily activities (Malik, Willet & Hu, 2013). The body stores these excess calories as fat (Pendpid & Peltzer, 2015). When energy intake and energy expenditure is not balanced, weight gain occurs (ACSMs, 2014).

2.4.1 Physical inactivity

Physical inactivity is a term used to identify individuals who do not get the recommended level of regular physical activity (WHO, 2018). When a person is not physically active, does not participate in any physical activity or sporting court. More energy will then be stored resulting in excessive weight gain since no calories will be burned (WHO, 2018). Moreover, a person can easily take in more calories everyday than they use through normal physical exercise and daily activities (Flegal *et al*., 2017). The American Heart Association recommends 30-60% of aerobic exercise three to four times per week to avoid weight gain (Rangaswami, Bhalla, Blair, Chang, Costa, Lentine, Lerma, Mezue, Molitch, Mullens & Ronco, 2019).

Flegal, Carroll and Ogden (2016) stated that even-though the benefits of PA have been documented worldwide, more than half of adults do not engage in regular physical activity. Moreover, approximately 60% of the global population fail to achieve the minimum amount of physical activity recommended (Rangaswami *et al*., 2019). Evidence suggests that South Africa is a physical inactive country (HSRC, 2017). An estimated 46% of South Africans do not meet the required 30 minutes of exercise for 3-5 days per week. (Statistics South Africa, 2016). Globally, about 31% of adults aged 15 and over were insufficiently active in 2008 (men 28% and women 34%). Approximately 3.2 million deaths each year are attributable to insufficient physical activity (WHO, 2018).

2.4.2 Sedentary lifestyle

The Sedentary Behaviour Research Network (SBRN, 2017) defined a sedentary lifestyle as a "mode of living which involves little or no physical activity, it describes behaviours of sitting, reclining or lying down while awake." Such behaviours involve watching Television (TV) for prolonged hours, driving, working behind a desk, using computers and mobile devices (SBRN, 2017). Sedentary behaviours result in excessive weight gain as they are very low in energy expenditure, thus leading to chronic diseases and mortality rates (DoH, 2015).

Technology has transitioned the world into a sedentary world. As time elapses, sedentary behaviour increases due to westernization. In fact, an estimated 67% of adults reported sitting for more than eight hours per day, and only 28% to 34% of adults ages 65-74 are physically active (Department of Health and Human Services, 2017). Sedentary lifestyles result in obesity

and other conditions such as venous thrombosis (potentially fatal blood clots that form in the deep veins of the legs (Flora & Nayak, 2019).

Per a study by Shields (2015), approximately 25% of men and 25% of women who reported watching TV 21 or more hours per week were classified as obese. The prevalence of obesity was substantially lower for those who averaged 5 or fewer hours of TV per week (14% of men and 11% of women). In addition, a study by Monica and John (2018) which examined multivariate models for controlling leisure-time, physical activity and diet, found that the associations between time spent watching television and obesity persisted for both sexes. In addition, frequent computer users (11 or more hours per week) in both sexes had increased odds of obesity compared with those who used computers for 5 or fewer hours per week. Contrary to these findings, Hayes, Dowd, MacDonncha and Donnelly (2019) in their study found that time spent reading is not related to obesity.

2.4.3. Eating habits

Eating habits are the ways a person eats considered in terms of the types of food consumed, the quantity and the duration (Lee & Nieman, 2016). Weight gain is inevitable if one often eats more calories than they burn (WHO, 2017). Moreover, most Americans' diets are too high in calories and are full of fast foods and high calorie beverages (Fuhrman, 2018). Human beings gain their nourishment from foods and drinks which are consumed at various times in a day (WHO, 2017; Fuhrman, 2018). The body gets its supply of nutrients from the food it consumes (Ogden *et al.*, 2016). In addition, unhealthy eating habits are often seen on people who eat a lot of junk food that also tends to affect their health (Koplan & Dietz, 2015).

Unhealthy eating can either be eating habits that do not fulfill the body's requirements due to a deficient diet or excessive diet, which results in weight gain, low energy levels, and poor general health overtime (Ogden *et al*., 2016). Furthermore, these include low intake of fruit and vegetables and high intake of fizzy drinks and fried foods. Unhealthy diets especially those with a high content in fat, free sugars and salt are the leading causes of NCDs (WHO, 2017; Fuhrman, 2018). Around 2.7 million deaths are attributable to diets low in fruits and vegetables. Worldwide, low intake of fruits and vegetables is estimated to cause about 19% of gastrointestinal cancer, about 31% of coronary heart disease and 11% of stroke (Kirunda *et al*., 2015).

Eating habits also have a bearing on the development of obesity (WHO, 2017). Skipping breakfast may lead to over-consumption later in the day. In fact, those who eat out more on average, have a higher BMI than those who eat at home (Lim, Xue & Wang, 2020). Moreover,

overeating, eating the wrong foods and not consuming breakfast have been reported as the other causes of overweight and obesity (Al-Rethaiaa, Fahmy & Alshwaiyat, 2010). There is an existing conflict in modern societies between the foods people desire (fatty, sweet and salty foods) and the desire to be healthy. There is also a difference between what people know and what they do, most of the people know that eating fatty or sugar foods in excessive amounts is bad for them, and that exercise is good for them (Lim, Xue & Wang, 2020). However, they tend to enjoy eating these foods and find it difficult to exercise (Van den Berg, Okeyo, Dannhauser & Nel, 2012). On the contrary, in their study among undergraduate students, Lupi, Bargordo, Stefanati, Grassi, Piccini, Begamini and De-Donno (2015) reported that students who take fatty foods also took fatty foods spend most of their time in sports activities.

Eating habits are associated with the adoption of a more western lifestyle and represent nutrition transition in developing countries (Fuhrman, 2018). When compared to other Sub-Saharan African countries, South Africa is further along the nutrition transition characterized by higher intakes of dietary energy and fat intake as well as higher levels of obesity than other countries (Micklesfield, Lambert, Hume, Chantler, Pienaar, Dickie, Puoane & Goudecke, 2013).

The modern diet has changed from one consisting of more complex carbohydrates, whole grains and fibres to one with high animal fats and proteins, refined carbohydrates, sugars and few fruits and vegetables (Brouns, 2018). Traditional cooking and homemade foods have been replaced by high-fat, energy dense fast foods and soft drinks (Fuhrman, 2018). People choose energy-dense, nutrient-poor fast foods because they are cheap, tasty, widely promoted and readily available (Micklesfield, 2018). Energy-dense foods tend to be high in fat (such as butter, oil and fried foods), sugar or starch, while energy –dilute foods have higher water content such as fruits and vegetables (Ha, Chung, Lee, Kim, Joung, Paik & Song, 2016). There is convincing evidence that a high intake of energy dense foods induces weight gain, whereas a high dietary fibre intake helps protect against weight gain (Koplan & Dietz, 2015; WHO, 2017). There is also evidence suggesting that free sugars, which are defined as sugars added to foods by the manufacturer, cook or consumer, plus sugars naturally present in honey, syrups and fruit juices, increase the energy density of diet without providing much specific nutrients and results in positive balance of total energy intake (Fuhrman, 2018).

2.4.4. Genetics

Genetics are defined as the study of genes or heredity. It is a biological process whereby parents pass genes to their children (Paoli, Tinsley, Bianco & Moro, 2019). Every child carries genes from both their biological parents and these genes in turn express specific traits.

Moreover, one`s genes may affect the amount of body fat he/she stores as well as where that fat is distributed. Genetics may also play a role in how efficiently the person`s body converts food into energy and how the body burns those calories through exercise (Popkin, Corvalan & Grummer-Strawn, 2020).

There is a significant link between obesity and genetics. If an individual`s parents are obese, the risk of the child being obese is significantly great (Viner, Costa & Johnson, 2019). The strongest risk factor for childhood and adolescent obesity is parental obesity. The risk becomes especially elevated if both parents are obese. Having both obese parents makes a child six times more likely to be obese himself, having only one obese parent still makes the child twice as likely as children of non-obese parents also tend to be obese (Flora & Nayak, 2019).

2.4.5. Racial, ethnicity and gender

The prevalence of obesity has reached epidemic proportions in the US, where approximately 68% of the population is obese or overweight (Flegal, Carroll & Ogden, 2016). Additionally, racial and ethnic minority populations are disproportionately affected by the obesity epidemic. Among Latinos, now the fastest growing minority in the U.S., the prevalence of obesity is higher (38.7%) compared to non-Latino whites (32.8%) (Agha & Agha, 2017). Furthermore, Age-standardized prevalence of obesity among female adults aged 40-59 years and 60 years or older increased from 33.7% in 2007-2008 to 39.6% in 2015-2016 (Hales, Fryar, Carroll, Freedman & Ogden, 2018). Also, increases in obesity and severe obesity prevalence persisted among adults, but there were no significant trends among youth (Hales *et al*., 2018).

In South Africa, the prevalence of overweight and obesity is 65.1% and 31.3% for black women and men respectively (Mashinya, Alberts, Cook & Ntuli, 2018). Similarly, trends of high prevalence of overweight and obesity in adult's population residing in rapidly urbanized communities in the Northern region of Ghana was revealed to be 33.1% among women and 10.3% among men (Kirunda *et al*., 2015). In addition, the high female-to-male ratio is predominantly observed in LMICs whereas in high-income countries, there is rarely a different between men and women (Hamer, O`donovan & Stamatakis, 2019). The Southern African region-a middle-income country is undergoing a rapid epidemiologic transition, influencing the rise in obesity rate in the country (Mashinya *et al*., 2018).

2.4.6. Environmental factors

Environmental factors can significantly determine energy intake and physical activity (Carbone, Del Buono, Ozemek, & Lavie, 2019). Modern society can be classed as an

"obesogenic" environment, which is a condition caused by the effects of the surrounding towns and cities people reside in (Carbone *et al*., 2019). Opportunities on how food can be easily accessed have an input on promoting obesity in individuals and populations (Zhang, Zhang, Zhao, Huang, Deng, Li, Pan, Li, Chen, Zhou & Yu, 2020). Our homes, neighbourhoods, schools and communities can all become environments that promote obesity (Carbone *et al*., 2019). The term has been coined to describe an environment where physical activity is discouraged and unhealthy food consumption is encouraged (Nguyen, Bauman & Ding, 2019). 2020). Furthermore, the term relates to the social, cultural and infrastructural conditions that influence our ability to adopt unhealthy lifestyles (Zhang *et al*., 2020).

The availability and consumption of different foods in the corners of the streets and high levels of physical inactivity are some of the environmental factors that lead to obesity (Bahadoran, Mirmiran & Azizi, 2015). In urban areas and developed economies, there are plentiful sources of relatively cheap foods and the price of food influences the food choices people make (Chen & Antonelli, 2020). In most cases, cheaper food sources tend to be more energy-dense and nutrient poor (Popkin, Adair & Ng, 2016). Energy-dense food provides plenty of calories in the form of fats and sugars, but relatively low levels of vitamins, minerals and fibre (Drewnowski, 2018). On the other hand, prices for fruits and vegetables are high, while prices for fats, oils and sugars are low (Popkin, Adair & Ng, 2016). The environment must have access to playgrounds; with pedestrian pathways and sports facilities to promote participation in exercise and physical activity (El Ansari, Suominen & Samara, 2015). Lack of training facilities on the street corners significantly contributes to overweight and obesity (Chen & Antonelli, 2020).

2.4.7 Socio-economic factors

Socio-economic status (SES) is another pivotal factor that influences dietary quality and food choices (Li, Figg & Schüz, 2019). SES is generally used to identify a person`s status relative to others based on characteristics such as income, qualifications, type of occupation, and where they live (Ulijaszek, 2012). According to Micklesfield *et al*. (2013), increased wealth and income contribute to food choices and are associated with the aspiration to consume more meat products, bigger portions, and a more frequent intake of fast foods, while low household food security is associated with poor dietary quality, characterized by low food variety and diversity scores.

Jackson, Yang and Zhang (2018) stated that obesity prevalence decreases as household income increases and as the education of the head of household increases (Li, Figg & Schuz, 2019). Although these relationships are not as consistent across race and ethnic groups in

other cases, obesity increases when the household income and head-of-household education increases (Whitelock & Ensaff, 2018). Household food security may be described as a continuum, from food security to food insufficiency. There are some concerns regarding having enough funds to buy foods for the month without changing the diet (Jackson, Yang & Zhang, 2018). Low food security typically reduces the quality of the diet, while in food insecure there is a reduced food intake and skipping of meals (Mickesfield *et al*., 2013).

Obesity is more prevalent in the poor population (Luhar, Mallinson, Clarke & Kinra, 2018). People with lower incomes consume a high fat energy dense diet because it is more affordable than a healthier diet comprised of lean meats, fresh fruits and vegetables (Adair & Lopez, 2020). The lesser the money you have, the less inclined you feel to spend it on wholesome food (Luhar *et al*., 2018). A millionaire may enjoy breakfasting off orange juice and biscuit while an unemployed man does not (Adair & Lopez, 2018). Well-planned nutritious meals are more difficult to have and maintain when finances are tight (Conde & Borges, 2016). In their study, Larson, Story and Nelson (2017) reported the prevalence of obesity to be the highest among those with high socio-economic status.

Over the past 30 years, obesity has been steadily increasing, even in low and middle-income countries, including those in SSA (Volaco, Cavalcanti & Précoma, 2018). From around 1975 to date, urbanization has been increasing steadily in SSA (Ali *et al*., 2017). In addition, urbanization is accompanied by a massive growth of industry, especially that of food manufacturing in urban areas of Africa (Biadgilign, Mgutshini & Haile, 2017). This has resulted in the emergence and popularization of soft drinks and fast foods and many Western brand names on the names on the continent (Brouns, 2018). In many urban areas, such Western food items are desirable status symbols, rapidly inculcated by local inhabitants and widely consumed (Volaco, Cavalcanti & Précoma, 2018). These products are disproportionately expensive in relation to average incomes and frequently of undesirable nutritional value (Pienaar, 2015).

2.4.8 Psychological factors

Psychological factors have to do with behaviours and personality factors which contribute significantly to the development of overweight and obesity (Popkin, Adair & Ng, 2016). These include stress and eating disorders.

2.4.8.1 Stress

The adaptive response's psychological regulator to stressors becomes deregulated over time with excessive or repeated stimulation, resulting in the deregulation of glucocorticoids (Wang,

2015). Glucocorticoids are hormones that play an important role in appetite regulation (Wolf, 2013). In a stressful situation following hours and days, the release of glucocorticoids results in the stimulation of feeding (Ali & Crowther, 2014). If the stressor becomes chronic, glucocorticoids can become chronically elevated, leading to chronically stipulated appetite, increased feeding and consequent obesity (Wang, 2012). Glucocorticoids also play a role in the regulation of lipid metabolism and homeostasis (Ali & Crowther, 2015). Excessive glucocorticoids are associated with increased visceral fat deposition; a phenotype associated with increased risk of CVD (Wolf, 2013).

Chronic stress, and the result of increased glucocorticoids, can both predispose an individual to obesity or worsen an existing obese phenotype (Packer, 2018). There is compelling evidence that the intrauterine and neonatal environment may contribute to obesity in adults (Vander Velden & Osborne, 2021). In addition, psychological stress at critical periods of development may be one of those factors (Derman, Whitesman, Dreyer, Patel, Nossel, Lambert & Schwellnus, 2014).

2.4.8.2 Eating disorders

The most common eating disorders are anorexia nervosa, bulimia nervosa and binge eating, with binge eating disorder means eating large amounts of food in short period, usually alone without being able to stop when full (Bardone-corne, Wonderlich, Frost, Bulik, Mitchelle, Uppala & Simonich, 2014). Overeating and bingeing are often accompanied by feeling out of control followed by feelings of depression, guilty or disgust (Sominsky & Spencer, 2014). Binge eating that is not followed by purging may also be considered an eating disorder and can lead to weight gain (Packer, 2018). More than one third of obese individuals in weight-loss treatment programmes report difficulties with binge eating (Mvo, Dick & Steyn, 2015). Eating problems contribute to feelings of shame, loneliness, poor self-esteem and depression (Bardone-corne *et al*., 2014). A person may binge or overeat for emotional reasons, including stress, depression and anxiety (Annugur, 2011). Hairies and Neumark-Sztainer (2014) argued that there is an association between rising levels of obesity and eating disorders, while Rigby (2013) stated that obesity is multi-factional and that in many cases psychological factors play a role in obesity.

2.5 Complications associated with obesity

People who are obese are prone to quite a great number of complications and relatively serious health problems (Zheng, Ley & Hu, 2018). These include high blood pressure, type 2 diabetes and high cholesterol amongst others.

2.5.1 High blood pressure

Obese people are also prone to have high blood pressure, commonly known as hypertension. High blood pressure (HBP) is a condition whereby the force of blood pushing against the walls of the arteries as the heart pumps blood is elevated (Jacobson, 2020). If the pressure stays high for prolonged periods of time it can have adverse effects on the body in various ways (Lategan, Van den Berg & Walsh, 2014).

Overweight and obesity have been reported to be the most significant determinants of hypertension, wherein a 10% rise in body weight has been shown to be associated with a 7 mmHg rise in SBP (Ferreira, 2018). The National Health and Nutrition Examination Survey (NHNES) reported linear association between an increase in BMI, systolic blood pressure (SBP), diastolic blood pressure (DBP) and pulse pressure in the American population (Jackson *et al.*, 2018). It has been reported that an increase in of BMI of 1.75 kg/m² in men and 1.25 kg/m² in women will cause 1mm Hg rise in systolic and diastolic blood pressure (Jackson *et al*., 2018) Thus, obese patients are more prone to hypertension and hypertensive patients also appear prone to weight gain (Amira, Sokunbi & Sokunbi, 2012).

A strong relationship shows the existence between body weight and blood pressure, with the risk of developing hypertension being two to six times higher in excessive weight individuals than in people with normal body weight (Vaneckova *et al.*, 2014). Excessive weight and obesity are associated independently with an increased risk for heart failure, while weight loss leads to decreased blood pressure (Jackson *et al*., 2018) This is because weight loss is associated with reductions in vascular resistance, total blood volume and cardiac output, suppression of the activity of the renin-angiotensin-aldosterone system (Oni, Odia & Ireungbukpe, 2014). It has been found that 5.1 kg of weight loss is caused by a reduction of 4.44 mmHg and 3.57 mmHg in systolic and diastolic pressure, respectively, translating to a reduction of 1.05 mmHg in systolic and 0.92 mmHg in diastolic pressure per kilogram of weight lost (Jackson *et al*., 2018). Markers of general obesity and indicators of abdominal obesity and indicators of abdominal obesity are good predictors of cardiovascular risk (Lategan, Van den Berg & Walsh, 2014).

2.5.2 Type 2 diabetes

Obesity adds pressure on the body`s ability to use insulin to properly control blood sugar levels thus increasing the chances of type 2 diabetes (Liaset, Oyen, Jacques, Kristiansen & Madsen, 2019). This condition is defined as an impairment in the way the body regulates and uses sugar as a fuel (Liaset *et al*., 2019). Normally the body breaks down food into glucose and then carries it to cells throughout the body (Volaco, Cavalcanti & Précoma, 2018). The cells

use a hormone called insulin to convert the glucose into energy (Carbone *et al*. 2019). In type 2 diabetes, the body`s cells do not use insulin properly. At first, the body reacts by making more insulin (Zheng, Ley & Hu, 2018). Eventually, high blood sugar levels can lead to disorders of the circulatory, nervous and immune systems (Volaco, Cavalcanti & Précoma, 2018).

Whitelock and Ensaff (2018) further mentioned that there is a close association between obesity and type 2 diabetes. The likelihood and severity of type 2 diabetes are closely linked with BMI (Santos & Barros, 2016). There is a seven times greater risk of diabetes in obese people compared to those of healthy weight, with a threefold increase in risk for overweight people, whilst it is known that body fat distribution is an important determinant of increased risk of diabetes, the precise mechanism of association remains unclear (Afrin, 2016). Obesity increases insulin resistance and glucose intolerance via these metabolic effects, obesity plays a major role in the pathophysiology of type 2 diabetes (Bonnie, Stratton & Kwan, 2015). Insulin resistance may be present 10-20 years before the onset of the disease, and is the best predictor of whether an individual will later become diabetic (Zheng, Ley & Hu, 2018). It is also uncertain why not all people with type 2 diabetes are obese (Chang, Yang & Shun, 2021).

2.5.3 High cholesterol

Obesity leads to increased cholesterol which is referred to as hyperlipidaemia (Zheng, Ley & Hu, 2018). Hyperlipidaemia is a condition in which individuals have an excess of fatty substances called lipids, largely cholesterol and triglycerides in the blood (Volaco, Cavalcanti & Précoma, 2018). High lipids levels can speed up to a process called atherosclerosis (Liaset *et al*., 2019). Arteries are normally smooth and unobstructed on the inside, but as age increases, a sticky substance called plaque forms in the wall of the arteries (Koplan & Dietz, 2015). Plaque is made of lipids and other materials circulating in one`s blood (Zheng, Ley & Hu, 2018). As more plaque builds up, arteries can narrow and stiffen (Carbone, 2019).
Hyperlipidaemia has been implicated in atherosclerosis, which is the primary cause of heart diseases and stroke (Lee, Hairi & Moy, 2017). It is well known that obesity is positively associated with an increased risk of atherosclerotic diseases (Lim, Xue & Wang, 2020). Moreover, Klop, Elte and Cabezas (2013) emphasized that cardiovascular risk factors such as increased fasting plasma triglycerides, high density lipoprotein (HDL) also known as “good cholesterol, low density lipoprotein (LDL) also known as “bad cholesterol”, elevated blood glucose and insulin levels and high blood pressure occur because of increased weight.

2.6 Strategies aimed at preventing and managing overweight and obesity

Many strategies have been suggested by health institutions such as the CDC to prevent and control overweight and obesity. This literature focused on weight-loss programs, regular exercise, healthy eating plans, identification of traps that result in overeating, regular monitoring of weight and consistency.

2.6.1 Weight-loss programs

The widespread prevalence of obesity makes effective weight-loss programs vitally important (Ngala, 2020). However, most successful weight loss programs require interventions of considerable intensity, duration, frequency and cost; thus, implementation and sustainability are major challenges (Mcmary, 2017; Lukaski, 2017). Translating clinically proven weight loss strategies for implementation in real-world settings requires understanding the ways in which obesity and weight are perceived in each community (Mcmary, 2017).

2.6.2. Regular exercise

One needs to engage in moderate physical exercise to prevent the occurrence of obesity (Rippe, 2018). That is approximately 150 to 300 minutes of exercise a week (Ngala, 2020). Moderate exercise includes brisk walking, aerobic dance, stationery jogging, rope skipping and swimming (Rippe, 2018; Ngala, 2020).

2.6.3 Healthy eating plan

Low calorie, nutrient- dense foods, such as fruits, vegetables and whole grains (Li, Figg & Schüz, 2019). People must eat 3 meals a day at regular intervals with limited snacking (Popkin, Adair & Ng, 2016). Junk food such as sweet and fizzy drinks must be avoided. They can be eaten occasionally (Li, Figg & Schuz, 2019).

2.6.4 Identification of traps that result in overeating.

Things that trigger one to eat in an uncontrollable manner must be known and avoided. This can be achieved by keeping a journal and writing down what to eat, how much and when (Popkin, Adair & Ng, 2016). After some time one would be able to see the change in the patterns. Furthermore, a planning and development of strategies for handling these types of situations and staying in control of eating behaviours can follow thereafter (Li, Figg & Schüz, 2019).

2.6.5 Regular weight monitoring

People should weigh themselves at least once a week so that they can be more successful in keeping off excess pounds (Greenway, 2015). Monitoring weight can help one realise whether

the steps he/she has taken to maintain weight are working or not and to quickly detect weight gain and do something about it before it gets out of hand (Schutz, Busetto, Dicker, Farpour-Lambert, Pryke, Toplak, Widmer, Yumuk & Schutz, 2019).

2.6.6 Consistency

It is of great importance for one to stick to his/her weight plan all the time, be it week days, holidays, weekends, vacations and whatsoever (Greenway, 2015). This helps to increase chances of long-term success (Schutz *et al*., 2019).

2.7 Conclusion

The rate of obesity is increasing at a high level. This epidemic is associated with serious comorbidities, increased mortality, reduced quality of life and a significant economic burden. This problem also results to serious medical complications. Therefore, strategies to achieve and maintain a healthy body weight throughout life are critical and they must take number one priority so that the present generation can be protected and the upcoming generations can be saved too. This chapter provided a review of existing literature which outlines the prevalence of overweight and obesity from a global to a local perspective. Moreover, literature endorses that overweight and obesity are associated with unhealthy lifestyle habits, including lack of participation in physical activity, unhealthy eating practices, smoking, and high consumption of alcohol. Overweight and obesity result in serious health complications, including hypertension and diabetes, amongst others.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter focused on describing and explaining in detail the study approach and design, area of study, target population and sampling method, instruments, pre-test, data collection method, ethical considerations, dissemination and implementation of results.

3.2 Study Approach and Design

Quantitative research approach was used to investigate the prevalence and associated health risk factors of overweight and obesity among educators in Nkomazi Local Municipality, Ehlanzeni District, Mpumalanga Province. A quantitative approach measures the magnitude, size, and extent of the phenomenon. It allows the investigation of numerous factors, which relate to the research questions and the relationships that may exist between them (Creswell, 2016). A quantitative approach in this study enabled the researcher to identify the relationships between variables and to present the findings in tables and charts.

The study adopted a cross-sectional design. This type of survey was chosen because it allows the researcher to collect data at one point in time using a large sample to compare different variables simultaneously (Barrie, Michael, Gibney & Lenore, 2015). The cross-sectional survey was descriptive in nature. Therefore, the researcher described the prevalence and associated health risk factors of overweight and obesity among secondary school educators in Nkomazi Local Municipality, Ehlanzeni District, Mpumalanga Province.

3.3 Area of Study

The study was conducted at Nkomazi Local Municipality. Nkomazi Municipality is a small municipality located in the eastern part of the Ehlanzeni District region of the Mpumalanga Province. The municipality is strategically placed between Swaziland (North of Swaziland) and Mozambique (East of Mozambique). It is linked with Swaziland by two provincial roads and with Mozambique by a railway line and the main national road (N4). There are several villages in Nkomazi local municipality, such as Jeppes Reef, Kamhlushwa, Malelane, Mzinti and Tonga. Moreover, the selected schools are within those villages (see Figure 1) below which indicate the schools selected.

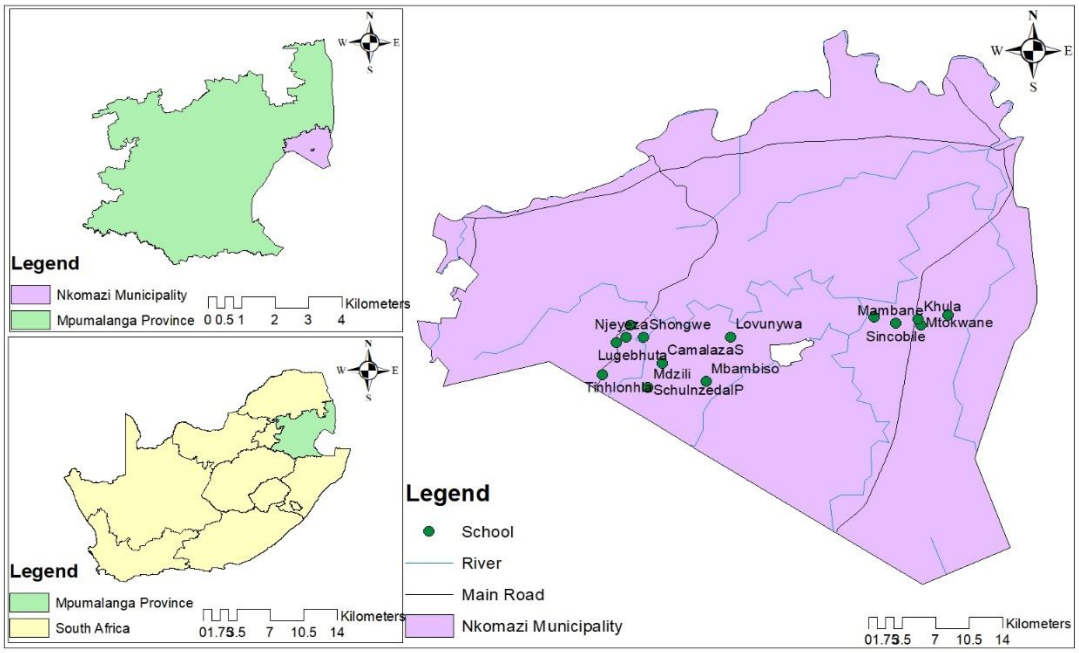

Figure 3.1 Map showing secondary schools within Nkomazi Municipality

Source: GPS Mapping, 2019

Table 3.1 below shows the distribution of circuits and the overall number of schools in Nkomazi Local Municipality. Nkomazi local Municipality consists of 5 circuits; namely, Malelane, Khulangwane, Lubombo, Nkomazi East and Nkomazi West circuits. There are 101 primary schools, 20 combined and 38 secondary schools adding to a total of 159 schools in the Nkomazi Municipality.

Table 3.1 Distribution of schools in Nkomazi Municipality

Name of the circuit	No of primary schools	No of combined schools	No of secondary schools	Total
Malelane	24	2	6	32
Khulangwane	16	4	7	27
Nkomazi west	20	3	9	32
Lubombo	18	4	10	32
Nkomazi east	23	7	6	36
Total	**101**	**20**	**38**	**159**

Source: Mpumalanga Department of Basic Education annual report, 2018

3.4. Study population

The study population included all school teachers in Nkomazi Municipality. The target population for this study comprised of all secondary teachers in Nkomazi Municipality. The total number of secondary teachers in Nkomazi Municipality is 1010 as shown in Table 3.2 below. The accessible population in this study were all the secondary teachers who agreed to voluntarily participate in the study.

Table 3 2 Distribution of circuits, schools and secondary teachers in Nkomazi Municipality

Name of the circuit	No of secondary schools	No of secondary teachers
Malelane	6	158
Khulangwane	7	180
Lubombo	10	252
Nkomazi west	9	260
Nkomazi east	6	160
Total	38	1010

Source: Mpumalanga Department of Basic Education annual report, 2018

3.5 Sampling and sample size

The study used multistage sampling methods to sample the circuits, schools and participants.

3.5.1 Sampling of circuits

Simple random sampling was used to randomly select three circuits namely: Malelane, Khulangwane and Nkomazi east circuits. All the names of the five circuits were written down and put on a container, the first three which were drawn from the container formed part of the study. This type of sampling was used so that all the five circuits can have an equal likelihood of being selected.

3.5.2 Sampling of schools

All secondary school from the selected circuit were included in the study. Malelane Circuit had 6 secondary schools, Khulangwane circuit had 7 secondary schools and Nkomazi east circuit had 6 secondary schools. The total number of secondary schools were 19 from three selected circuits.

3.5.3 Sampling of participants

Simple random sampling methods were used to select secondary school educators. Simple random sampling is a type of probability sampling which gave the educators in the selected circuits in Nkomazi municipality an equal opportunity to be selected merely by chance, to participate in the study. The researcher got the names of all teachers from school principals in each and every school and numbered them systematically and in a consequent manner, by writing each name on a separate piece of paper. These pieces of papers were mixed and put into a box and the numbers were drawn out of the box randomly until the required number was reached.

3.5.4 Sample size

The Slovin's (1960) formula was used to calculate the sample size required to represent the total population.

$$n = \frac{N}{1 + N(e)^2}$$

n= sample size of adjusted population

N=population size

e= accepted level of error usually set 0.05

$$n = \frac{N}{1 + N(0.05)^2}$$

$$n = \frac{1010}{1 + 1010(0.05)^2}$$

= 286

To cater for non-response in a survey 10% was added.

Total sample size= 286+29

Total sample size= 315

The proportional sample size required in each school was determined by dividing the sample size with the total population of selected teachers multiplied by the total number of teachers per school, as shown in Table 3.3 below.

Table 3.3 Proportional sample

Circuit	Schools	Number of teachers	Sample size per school
Malelane	Tinhlonhla	28	315/498x28=18
	Lugebhuta	30	315/498x30=19
	Njeyeza	25	315/498x25=16
	Mahlatsi	27	315/498x27=17
	Suikerland	26	315/498x26=16
	Ndlela	22	315/498x22=14
Khulangwane	Sidlamafa	27	315/498x27=17
	Camalaza	26	315/498x26=16
	Lovunywa	25	315/498x25=16
	Manzolwandle	28	315/498x28=18
	Mbambiso	27	315/498x27=17
	Mdzili	24	315/498x24=15
	Shongwe	23	315/498x23=14
Nkomazi east	Cromati	28	315/498x28=18
	Khula	26	315/498x26=16
	Mambane	25	315/498x25=16
	Mehlobuvu	27	315/498x27=17
	Mjokwane	25	315/498x25=16
	Sincobile	29	315/498x29=19
	Total	**498**	**315**

3.6 Inclusion and Exclusion Criteria

3.6.1 Inclusion criteria

All secondary school teachers who agreed to participate and signed the informed consent form were included in the study.

3.6.2 Exclusion criteria

The secondary school teachers who were pregnant at the time of collecting data were excluded from the study because it would have been difficult to determine their correct body mass index (BMI).

3.7. Recruitment of Participants

First visit - The researcher visited the selected schools and requested for permission to conduct the study from the school principal. The meeting with the teachers was arranged with the school principal.

Second visit - The researcher requested a meeting with teachers to discuss the procedures for data collection as well as for distributing the information sheet and consent forms.

Third visit - The researcher explained the research procedures again before participants can sign the consent forms. Data collection resumed at this point.

3.8 Data collection instruments

The self-administered questionnaire as well as record sheet were used for data collection. In this section, instrument development and measurement techniques were discussed.

3.8.1 Instrument development

The instrument was developed following the objectives and relevant literature. The questionnaire was adapted from previous studies (Phetla, 2015; Mohlala, 2017; WHO steps for NCDs latest version, 2020). The self-administered questionnaire was developed in English without translation to local languages. The total population was graduates who are likely able to read and respond in English because most tertiary institutions use English as a medium of instruction, except for a few Afrikaans Universities. Moreover, given the linguistic diversity of the Mpumalanga province, English appeared as a suitable medium of communication for teachers to avoid translating to many languages which would have required a huge amount of time and resources. The questionnaire had six (6) sections which were as follows:

Section A: Socio-demographic profile

This section sought to gather gender, age, ethnicity, monthly income and level of education. The socio-demographic information gathered was used to determine the participants` backgrounds.

Section B: Lifestyle behaviour

Section B of the questionnaire sought to investigate educators' lifestyle habits that contribute to overweight and obesity. A modified question was adopted from (Food Dietary Guidelines for South Africa, 2013; CDC, 2017 and WHO, 2015). The questionnaire aimed to investigate whether educators practiced a healthy lifestyle in their daily routine or not.

(a) Smoking

The questions were adopted and modified from WHO (2015) and Malik, Willet and Hu (2015). The modified questions sought to determine smoking status of the participants.

(b) Alcohol consumption

The questions were adopted and modified from CDC (2017) and Mekonen, Fekadu, Chane and Bitew (2017). The modified questions sought to determine whether participants consume alcohol or not and the amount of alcohol that they consume.

(c) Nutritional practices

The questions were adopted from Food Dietary Guidelines for South Africa (2013) and Neupane, Fekadu, Chane and Bitew (2017). The questionnaire aimed to determine whether participants practiced healthy eating in their daily routine.

(d) Physical Activity

The questions were adopted and modified using the guidelines for International Physical Activity Questionnaire (IPAQ, 2002); Physical Activity Guidelines for Americans (2008); Santos and Barros (2018). The questions sought to determine whether participants engage in physical activities during their leisure time or not.

Section C: History of BP

This section sought to determine whether participants have a known high blood pressure disease and whether they control it or not. The questions were adopted and modified from American College of Sports and Medicines (ACSM) guidelines for cardiovascular health (2008) and WHO (2018).

Section D: History of Diabetes

This section sought to determine whether participants have a known diabetes disease and whether they control it or not. The questions were adopted and modified from ACSM Guidelines for Cardiovascular Health (2008) and WHO (2018).

Section E: Family history of obesity

This section sought to determine whether participants have a family history of overweight and obesity from their first degree relatives or not. The questions were adopted and modified from Guidelines for Cardiovascular Health (ACSM, 2008).

Section F: Record sheet

The researcher took anthropometric and clinical measurements of participants. Two trials were taken for each measurement.

3.8.2 Measurements and techniques

The researcher took anthropometric measurements, blood pressure, and glucose check on the same day of data collection. The research assistant recorded the readings on the record sheet. The measurements and techniques that were used are discussed below.

3.8.2.1 Anthropometric measurements

Anthropometric measurements were taken following the standard procedure described in Lee and Nieman (2012, pp. 161-169). The researcher took repeated anthropometric measurements. The following anthropometric measurements were taken weight, height, waist and hip circumference, chest, abdomen, triceps, Suprailiac and thigh measurements.

(a) Weight measurement

Body weight was measured using a Casa electronic glass bathroom scale. The scale was placed on a flat surface to sit securely without rocking. The known mass of 2kg was used to calibrate the scale. The scale was zeroed each time before weighing the participant. The participant stood on the scale without shoes and wearing minimal clothes. The feet were evenly distributed on the scale. For accuracy, the measurement was repeated and recorded on the record sheet to the nearest 0.1kg. The scale was checked periodically and calibrated when moved.

(b) Height measurement

The standing height/stature was measured using a Harpenden stadiometer. The stadiometer was placed on an even area against the wall. Participants stood on the stadiometer barefooted. Participants were asked to look straight ahead with head on the Frankfurt plane. Shoulders were relaxed, with shoulder blades, buttocks and heels touching the audiometer's stand. Arms were relaxed at sides, legs straight and knees together. Feet flat and heels together. Two measurements were taken and recorded in the appropriate section of the questionnaire. If the two measurements differed by more than 0.1 cm, a third measurement was taken. The two measurements which were nearer to each other were then selected.

(c) Interpretation of weight and height measurements (Body mass index)

The height and weight measurement were used to compute BMI which is obtained by dividing the weight (in kilograms) with the height (in Meters) squared. BMI helped the researcher to classify the extent of overweight and obesity among educators in Nkomazi Municipality. The values and their classifications are explained in Table 3.4 below.

Table 3.4 Body mass index cut-off points (WHO, 2016)

Values	Classification
< 18.5	Underweight
18.5-24.9	Normal
25.0-29.9	Overweight
30.0-34.9	Class 1 obesity
35.0-39.9	Class 2 obesity
Greater than 40	Class three obesity or extremely obese

(d) Total body fat percentage

The body fat percentage of a human is the total mass of fat divided by total body mass, multiplied by 100; body fat includes essential body fat and storage body fat (WHO, 2016).

(e) Procedure for measuring total body fat percentage

A slim guide skinfold calliper was used to measure the body fat percentage. The researcher took measurements on the right side of the body. The skinfold was grasped firmly by the thumb and index finger of the non-dominant hand. The researcher held the caliper with the right hand, perpendicular to the long axis of the skinfold and with the calliper's dial facing up and easily readable. The dial was read 4 seconds after the pressure. The researcher`s eyes and calliper dial was positioned to avoid errors caused by parallax. Readings were recorded to the nearest 1 mm. A minimum of two measurements were taken in each site. Measurements were taken 15 seconds apart to allow the skinfold site to return to normal. If consecutive measurements varied by more than 1 mm, more measurements were taken until there was consistency. The researcher maintained the pressure with the thumb and index finger throughout each measurement.

(f) Interpretation of total body fat percentage

Body fat percentage measures body composition and it indicates how much of the participant`s weight is fat. The ranges for body fat percentage differs for men and women as shown in Table 3.5.

Table 3.5 Total body fats percentage cut-off points based on BMI (Williams, 2017)

BMI (kg.m²)	Health risk	20-39 yrs.		40-59 yrs.		60-79 yrs.	
		Male	Female	Male	Female	Male	Female
<18.5	Elevated	< 8%	<21%	<11%	<23%	<13%	<24%
18.5-24.9	Average	8%-19%	21%-32%	11%-21%	23%-33%	13%-24%	24%-35%
25.0-29.9	Elevated	20%-24%	33-38%	22%-27%	34%-39%	25%-29%	36%-41%
>30	High	≥25%	≥39%	≥28%	≥40%	≥30%	≥42%

(g) Waist circumference measurement

Waist circumference was measured using an anthropometric tape measure. The researcher stood in front of the participant to correctly locate the narrowing of the waist. The measurements were taken at the end of normal expiration with the arms relaxed at the sides. With the participant standing, arms at the sides, feet together, and abdomen relaxed, a horizontal measurement was taken at the narrowest part of the torso (above the umbilicus and below the xiphoid process Two measurements were taken and recorded in the appropriate space in the record sheet of the questionnaire.

(h) Hip circumference measurement

Hip circumference was also measured using an anthropometric tape measure The researcher stood at the side of the participant to ensure that the tape is held in a horizontal plane when the site is measured. During measurements, the participant stood erect with the feet together and without volitionally contracting the gluteal muscle. With the participant standing, legs slightly apart (~10 cm), a horizontal measure was taken at the maximal circumference of the hip or proximal thigh, just below the gluteal fold. Two measurements were taken and recorded.

(i) Interpretation of waist and hip ratio

The WHO (2016) states that the waist to hip ratio is the dimensionless ratio of the circumference of the waist to that of the hips. It is calculated as waist measurement divided by hip (W÷H). It is a good indicator of visceral fat which result in android obesity. A WHR of over 0.86 indicates obesity in women and a WHR of over 0.95 indicates obesity in men. The WHR cut off points is shown in detail in Table 3.6 below for both men and woman.

Table 3.6 Waist and Hip ratio cut-off points for men and women (Mcmarry, 2017)

Gender	Excellent	Good	Average	At risk
Males	< 0.85	0.85-0.89	0.90-0.95	> 0.95
Females	<0.75	0.75-0.79	0.80-0.86	>0.86

3.8.2.2 Blood pressure measurements

Measuring BP is crucial, it helps to determine whether a person has HBP or not. Usually, HBP has no warning signs and symptoms, and many people do not know they have it until they have a check-up. In addition, BP measurement is also a tool used to identify if a person is at risk for heart diseases or stroke.

(a) Procedure for taking blood pressure measurement

An automatic sphygmomanometer was used to take the measurements of systolic and diastolic blood pressure. Participants were requested to sit quietly for at least 5 minutes in a chair, with the back supported, feet on the floor and the arm supported at the heart level. Participants were told a day prior measurement to refrain from smoking cigarette or ingesting caffeine 30 minutes' prior measurements to have accurate results.

A large adult cuff was wrapped firmly around the upper arm at heart level aligned with the brachial artery. A blood pressure monitor machine was turned on to inflate the cuff, the participants were asked to remain still while the cuff was inflating until the testing stops and the cuff deflates, and the monitor displays the results. The results were recorded at the same time, and the procedure was repeated to obtain a second reading. The participant`s blood pressure was classified per the protocol as suggested by (ACSMs Guidelines, 2010).

(b) Interpretation of blood pressure

Blood pressure is the pressure circulating blood on the walls of blood vessels. Most of this pressure is due to work done by the heart by pumping blood through the circulatory system. Blood pressure is summarised by two numbers namely systolic and diastolic blood pressure. The interpretation of blood pressure is summarized in Table 3.7 below per cut-off points.

Table 3.7 Blood pressure per cut off points (American Heart Association, 2016)

Blood pressure category	Systolic mmHg (upper number)	Diastolic mmHg (lower number)
Normal	< 120	< 80
Prehypertension	120-139	80-89
Stage 1 hypertension	140-159	90-99
Stage 2 hypertension	≥160	≥100
High blood pressure crisis	>180	>110

3.8.2.3 Blood glucose measurement

Measuring the amount of glucose or sugar in the blood is also crucial. It is considered as one of the easiest and quickest ways of checking diabetes mellitus which is a dangerous lifestyle related disease.

(a) Procedure for taking blood glucose

A registered nurse used an Accu-chek machine to measure biochemical measurements. Blood glucose was measured to the nearest 0.1mmol/L. The nurse firstly ran the control test to ensure if both the meter and the test strips are working properly and giving reliable results by inserting a new memory chip on the Accu-check device to correspond to the test strips. After running the control, the machine was placed on a flat surface (table). Participants were asked to sit on a chair with the back supported, feet on the floor, hand hanging down below the waist, and gloves on. The left ring fingertip was cleaned with an alcohol swab and allowed to dry, to decrease haemolysis but not alter results.

The area was grasped gently and squeezed for three seconds. The finger was then pricked with a pricking needle, the first drop to come out was wiped away, and then approximately four drops of blood were collected using a capillary tube to be inserted into the test strips. One lancet was used per participant. An alcohol swab was placed on the small puncture to stop the blood. The test strip was then inserted into the Accu-check machine. The machine displayed the glucose results in less than five minutes. Used personal protective equipment (PPE) which included alcohol swab covers, strips cover used gloves and contaminated swabs were disposed to prevent the transmission of disease to the wider population through contact with bodily fluids. Lancets, blood strips and capillary tubes were thrown into red plastic bags.

(a) interpretation of blood glucose

Blood glucose literally refers to the amount of sugar in one's blood. This sugar comes from anything that the individual eats or drinks, plus the sugar stores that stay within the liver and muscles. Table 3.8 below shows blood glucose levels (BGL) interpretation per cut-off point.

Table 3.8 BGL cut-off points (American Diabetes Association, 2015)

Category	Values
Normal	<3.9-5.5
High risk	5.6-7.0
Very high risk	≥7.0

3.9. Pre-test of the instruments

A pre-test is defined as a preliminary test administered to a statistically smaller sample of participants before a full-scale study (Creswell, 2016). The researcher conducted a pre-test among a smaller sample of educators who were not selected to be part of the study within the nineteen schools in the three circuits (Malelane, Khulangwane and Nkomazi East) in order to confirm if the modified questionnaire is valid, easily understood, doesn't take too long to complete and to identify errors. The pre-test also helped the researcher and the research assistant to be familiar with the data collection instrument and tools.

The questionnaire was distributed amongst 30 teachers (10 teachers per circuit) which is 10% of the sample. The assistant was able to understand better her role and to ask for clarity where she did not understand and the researcher was able to determine the assistant`s readiness

for the fieldwork. The results from the pre-test were analysed to check if the questionnaire needs to be modified or not. Smoking related questions were reduced by removing repetitive questions. and open ended questions on alcohol consumption were replaced with closed ended questions. The Seca weighing scale was checked for accuracy by calibration prior measurements and by measuring an object of a known weight (5 kg dumbbell) and accurate measurement was obtained. Repeated measurements were taken for height, circumferences and skinfold measurements. The results of the pre-test ensured that the questions being asked accurately reflect the information that the researcher desires and that the participants can and will be able to respond to the questions.

3.10 Plan for data collection

Immediately after the permission to collect data in the respective schools was granted, data collection commenced. Specific appointments were made with the participants at least one week prior to data collection. The researcher was assisted by a trained research assistant to collect data. The researcher needed an assistant because the sample was large, extensive and there were many variables to measure hence collecting data solely would have required a huge amount of time and resources. The research assistant was trained for a week and she was also involved during pre-testing of the instrument and the test-retest method for reliability check. The Data collection took place after school to avoid the disruption of classes and it took place in the participants` respective offices or staff rooms. In order to ensure the smooth collection, the researcher arranged with school principals to have two data collection stations at each specific school. The first station was for collecting survey data through questionnaire. The researcher made sure the environment is comfortable and professional, chairs and tables were set up so the participants can sit down, and the researcher distributed the questionnaire to participants to complete. After filling the questionnaire, the educators were directed to station 2 for anthropometric measurements. Procedure for anthropometric measurements is described above. Data collection process took approximately 1 hour (30 minutes for the questionnaire and another 30 minutes for measurements per participant) and the whole process of data collection ran for approximately a month.

3.11 Data analysis

Data collected from the participants was entered into Ms excel worksheet for cleaning. Then after, data was transferred to the Statistical Package for Social Sciences latest version which is 26.0 currently for analysis. Descriptive statistics (mean, standard deviation and frequencies) were used to describe the data. Chi-square test (X^2) were utilized to determine the relationship between obesity and its associated risk factors, such as obesity and demography, lifestyle behavioural factors and obesity. Statistical level of significance was set at 5% (i.e. $p<0.05$).

Parametric and nonparametric tests were also used to analyse the data. Frequency tables and charts were employed to present the findings of the study.

3.12 Validity of the instruments

Validity is the extent to which a test measures what it is purported to measure (Heale & Twycross, 2015, p. 99). The validity of the questionnaire was ensured by means of face and content validity.

(a) Content validity

To ensure content validity, experts were consulted by the researcher to verify the readability, clarity, and comprehensiveness of the content to whether it covers all the dimensions of the construct literature. The experts gave comments which the researcher used before finalising the instrument.

(b) Face validity

To ensure face validity, the researcher presented the questionnaire in person to supervisors, previous researchers and panel of experts in the School Higher Degree Committee (SHDC) and University Higher Degree Committee (UHDC). The questionnaire was scrutinised by the experts in the field of public health to ensure a high degree of face validity.

3.13 Reliability

Reliability refers to the degree to which a particular test, procedure or tool, such as a questionnaire, will produce the same results if the same methodology is repeated (Barrie, Michael, Gibney & Lenore, 2015, p.106). Reliability was ensured by using the test-retest method with the same participants who were involved in pre-testing to assess the consistency of the results. The test-retest was done a week after the pre-test. The first results were compared with the second results set by calculating a correlation coefficient. In a case where the correlation value was close to zero, the researcher concluded that the instrument had a low reliability and in a case where the correlation value was close to one then the researcher concluded that the instrument had a high reliability. Reliability of the measurement tools was ensured by taking repeated measurements and all measurements were taken following a standardised procedure, the weighing scale was calibrated prior use (WHO, 2017).

3.14. Ethical considerations

Ethics in research have a role and there is a need to follow some basic ethical principles, observe key standards and rules. Thus, ethics provide a framework to protect participants (humans and animals). Ethics promote good science as participants who feel respected may agree to participate in the research, answer eagerly and truthfully thus contribute to high quality data.

3.14.1 Institutional Approval

The proposal was presented at Department of Public Health, School and University higher degree's committee and ethics committee. Ethical clearance was sought first from the University of Venda Research Ethics Committee Project no: SHS/19/PH/30/1612 (Appendix 7). After obtaining the approval and ethical clearance from the University of Venda, the researcher consulted the Department of Education (see Appendix 3) from Mpumalanga province to seek permission to conduct the study using the educators as participants. Once the permission was granted (see appendix 4), the circuit was informed about it. The principals from each selected school were also consulted before hand.

The researcher ensured that all the necessary ethical issues were followed throughout the study. The study was conducted following Helsinki declaration- ethical principles for medical research involving human subjects. Adopted by the 18th World Medical Association (WMA) General assembly, Helsinki, Finland, June 1964 and amended by the 64thWMA general assembly, Fortaleza, Brazil, October 2013. The following ethics were considered in the study:

3.14.2 Information sheet and informed consent

Information sheet and informed written consent (see Appendix 1&2) were given to the participants after the participants were fully informed about what was expected of them and the nature of the study. The participants who had agreed and signed the consent forms formed part of the study.

3.14.3 Privacy

Privacy refers to an individual's right to be free from intrusion or interference by others. It is a fundamental right in a free and democratic society. Individuals have privacy interests in relation to their bodies, personal information, expressed thoughts and opinions, personal communications with others, and spaces they occupy (Marlow & Boone, 2015). In this study, the researcher ensured privacy by collecting data in a respective office or staff room where other people were not allowed to enter during the data collection period.

3.14.4 Confidentiality and Anonymity

The ethical duty of confidentiality refers to the obligation of an individual or organisation to safeguard entrusted information. Confidentiality includes obligations to protect information from unauthorised access, use, disclosure, modification, loss or theft. Fulfilling the ethical duty of confidentiality is essential to the trust relationship between the researcher and participant, and for the integrity of the research project (De vos, Strydom, Fouche & Delport, 2015). The researcher ensured that all information obtained from the participants during the study remained confidential by keeping the information in a locker where only the researcher had

access to it. Anonymity was done to ensure that there is no link between information and the participants. The researcher used a fictitious code number which the participants were referred with in the data, any publication report or other research output.

3.14.5 Rights of participants

The participants are the focus of the study and without them there is no study. A participant`s right is recognised as one of the basic human rights for all persons. Participant`s rights are examined from the viewpoint of traditional ethics and the expression of individual participant`s needs, interest and rights in community situations.

3.14.5.1 Right to full disclosure

The researcher informed the participants regarding the study; for example, the nature, duration and purpose of the study. The participants were also informed about the methods, processes and procedures for data collection, and how the findings of the study will be used (Marlow & Boone, 2015).

3.14.5.2 Voluntary participation

The researcher ensured that participants get information prior to the study, for example that the study was voluntary. Therefore, they have a right to refuse to participate in the study, and have a right to withdraw at any time from the study without getting any penalties (Mcmary, 2017). An information letter and informed consent form were utilized to ensure that the participants did not feel forced to participate in the study.

3.14.5.3 Possible risks/discomfort

A minor discomfort was experienced during blood glucose measurement. The prick on the finger was a little bit painful but the pain fade away after some few minutes. In addition, a small sample of blood was drawn from the finger and that blood was only used for the research purpose which was to determine blood glucose and cholesterol level. Other than that, there were no known risks which were encountered by taking part in the study except for those that we experience in our daily lives.

3.15. Plan for dissemination of results

Hard copies of the study will be submitted to the Department of Public Health and the Library of the University of Venda. The findings will also be submitted or communicated to the Heads of each school selected and to the Ministry of Education. It is also envisaged that the findings will be published in peer-reviewed journals so that it will be accessible to many audiences.

3.16 Chapter summary

Chapter 3 described in detail the research methods which the researcher utilized in conducting the study. The chapter explained the techniques in which the methods were applied in order to address the objectives of the study. These methods include study approach and design, sampling procedures, plans for data collection, instrumentation, data analysis and ethical considerations. Upon application of these various methods, data was gathered and analysed and that leads to presentation and interpretation of findings in chapter 4.

CHAPTER 4

PRESENTATION AND INTERPRETATION OF RESULTS

4.1 Overview

This chapter presents the results of the study. The results are presented under the following categories: socio-demographic characteristics, lifestyle risk factors, anthropometric status, blood pressure, glucose level and correlation of anthropometric status with lifestyle risk factors.

4.2 Socio-demographic profile of the participants

The targeted sample size included 315 participants. However, only 295 participants successfully completed the questionnaire representing a 93.7% response rate. As indicated in Table 4.1, the participants were from three different circuits in Ehlanzeni District. The larger proportion (36.3%) were from Khulangwane followed by Malelane circuit with 33.9% and then Nkomazi east with 29.8%. About 55.6% of the participants were females whereas 44.4% were males. Most of the participants were between the age of 25 to 34 years 31.5%, followed by 35 to 44 years at 19%. About 41% of participants were single, 44.4% were married, 11.5% were widow/widower while 3.9% were divorced.

Almost all participants (96.6%) were of black race, with coloureds and Asians constitutes 2.4% and 1% respectively. In terms of highest qualification, almost two-thirds (61%) of the participants were in possession of a bachelor`s degree, while those having master's degree and PhD qualifications only accounted for 3.4% and 0.4% accordingly. Majority of participants had five or more years of working experience whereas only 22% had 1 to 4 years' experience of working. Almost half (48.8%) received an income of above R20 000.00 in their distinguished households while just few (1.4%) received below R10 000.00 monthly income. The majority of participants (86.4%) had household income of R15 000.00 or more while 13.6% had household income of less than R15 000.00 per month. Lastly, 38.3% of the participants were comprised of 3 to 5 household members followed by 5-8 members at 31.5%.

Table 4. 1 Socio-demographic profile of the participants

Characteristics	Frequency	Percentages
Circuit:		
Malelane	100	33.9
Khulangwane	107	36.3
Nkomazi east	88	29.8
Total	**295**	**100**
Gender:		
Female	164	55.6
Male	131	44.4
Total	**295**	**100**
Age Group:		
18-24	53	18.0
25- 34	93	31.5
35-44	56	19.0
45-54	52	17.6
55 and above	41	13.9
Total	**295**	**100**
Marital Status:		
Single	121	41.0
Married	131	44.4
Widow/widower	34	11.5
Divorced	9	3.1
Total	**295**	**100**
Race:		
Black	285	96.6
Coloured	7	2.4
Asian	3	1.0
Total	295	100
Highest level of Education:		
High certificate	3	1.0
National Diploma	58	19.7
Bachelor`s Degree	180	61.0
Honours degree	37	12.5
Master's degree	10	3.4
Doctorate(PhD)	2	0.4
Post graduate certificate in education	5	1.7
Total	**295**	**100**
Years of working in public facility:		
1-4 years	65	22.0
5-9 years	83	28.1
10 -14 years	45	15.3
More than 15 years	102	34.6
Total	**295**	**100**
Household monthly income:		
Below R 10.000	4	1.4
R 10.000-R 15 000	36	12.2
R 15 000-R 20 000	111	37.6
More than 20 000	144	48.8
Total	**295**	**100**
How many people in your household:		
Less than 3	43	14.6
3-5 people	113	38.3
5-8 people	93	31.5
More than 8 people	46	15.7
Total	**295**	**100**

4.3 Availability of a garden in the home yard

Participants were assessed on the availability of a garden on their home yards. Table 4.2 indicates that participants practise agricultural activities in their respective homes, because a higher proportion of 86.1% agreed to have a garden in their homes while a minority of 13.9% did not have any garden at home. Moreover, from those who had a garden about 45.3% had ploughing field, 26.8% had a vegetable garden and 27.9% had a fruit garden.

Table 4. 2 Availability of land for food production

Characteristics	Frequency	Percentages
Existence of a garden n=		
Yes	254	86.1
No	41	13.9
Total	**295**	**100**
Garden type (n=254)		
Fruits	71	27.9
Vegetable	68	26.8
Ploughing	115	45.3
Total	**254**	**100**

4.4. Lifestyle risk factors

The second objective of this study was to identify lifestyle risk factors (smoking status, alcohol consumption, nutritional practices and physical activity practices) associated with overweight and obesity among educators in Nkomazi Local Municipality, Ehlanzeni District, Mpumalanga Province.

4.4.1. Smoking

This section assessed participants' smoking status and history of smoking.

4.4.1.1 Smoking status

Participants were assessed on smoking cigarette, vapes, smokeless tobacco and hooka pipes. It is evident that some of the participants practise a lifestyle behaviour of smoking. Table 4.3 below shows that a noticeably 13.2% of the participants were smoking cigarettes daily, a minority of 6.4% smoked cigarettes less than a day, while a vast majority of 80.3% did not smoke cigarette at all. Relatively few participants (2.4%) agreed to use vapes or electronics cigarette daily, only 11.2% indicated that they did not use them every day while an enormous 86.4% did not use vapes or electronic cigarette at all. The findings further revealed that a minority of 1.7% of the participants use smokeless tobacco such as snuff, pipes and cigars

daily, just 14.6 % use them less than a day, while a multitude of 83.7% did not use smokeless tobacco at all. The findings also indicated that few participants (2.0%) use hooka pipes daily while as many as 80.6 % did not use hooka pipes at all.

Table 4. 3 Smoking status of participants

Frequency of smoking/using cigarettes	**Frequency**	**Percentage**
Daily	39	13.2
Less than day	19	6.4
Not at all	237	80.3
Total	**295**	**100**
Use of vapes or electronic cigarettes		
Daily	7	2.4
Less than daily	33	11.2
Not at all	255	86.4
Total	295	100
Use of smokeless tobacco		
Daily	5	1.7
Less than daily	43	14.6
Not at all	247	83.7
Total	295	100
Use of hooka pipes		
Daily	6	2.0
Less than daily	51	17.3
Not at all	238	80.6
Total	**295**	**100**

4.4.1.2 History of smoking

Participants were asked about their history of smoking. Table 4.4 shows that about 32.2% of the participants smoked years ago while a considerable number of 60.7% reported not to have a history of smoking at all.

Table 4. 4 History of smoking

History of smoking	Frequency	Percentage
Yes, years ago	95	32.2
Yes, months ago	16	5.4
Yes, days ago	5	1.7
Not at all	179	60.7
Total	**295**	**100**

4.4.2. Alcohol Consumption

This session assessed alcohol consumption status of the participants such as the frequency of alcohol consumption in the last year, number of drinks consumed in the last year and frequency of consuming drinks in one occasion.

4.4.2.1 Frequency of alcohol consumption in the last year

Participants were asked about the frequency of their alcohol intake. Alcohol consumption was another lifestyle behaviour which the participants practiced. Table 4.5 shows that some of the participants agreed that they consume alcohol monthly or less than a month (27.1%) followed by less than half (43.7%) who claimed that they have never consumed alcohol while only 6.4% attested that they drink more than four times a week.

Table 4. 5 Frequency of alcohol consumption (n =295)

Frequency of alcohol consumption in the last year	Frequency	Percentage
Never	129	43.7
Monthly and less	80	27.1
2-4 times a month	48	16.3
2-3 times a week	19	6.4
More than four days a week	19	6.4
Total	**295**	**100**

4.4.2.2 Number of drinks consumed in the last year

Participants were asked about the amount of drinks containing alcohol that they drank in the last year. It is clear that participants consumed alcohol frequently. Table 4.6 below demonstrates their responses pertaining the number of drinks containing alcohol they drank on a typical day when they were drinking in the last year. Almost half of participants (48.2%) said they consumed 1 to 2 drinks, about 11.4% claimed to have taken more than 10 drinks in

one day, 13.2% agreed to have taken 3 to 4 drinks per day while 15.7% said they took 7 to 9 drinks.

Table 4. 6 Number of drinks consumed in the last year (n=166)

Number of drinks in the last year	Frequency	Percentage
1-2 drinks	80	48.2
3-4 drinks	22	13.2
5-6 drinks	19	11.4
7-9 drinks	26	15.7
More than 10 drinks	19	11.4
Total	**166**	**100**

4.4.2.3 Frequency of consuming 6/more drinks on one occasion

The participants were also asked how often they had six or more drinks on one occasion in the last year. The study results indicated a high incidence of binge drinking whereby a total of 38.2% said they consume 6 or more drinks on one occasion daily followed by 30.9% who reported to consume these drinks weekly while a minimum of 6.7% reported that they had these drinks in less than a month (Table 4.7).

Table 4. 7 Frequency of 6 or more drinks in one occasion

Frequency of 6 or more drinks in one occasion	N=149	Percentage
Less than a month	10	6.7
Monthly	36	24.2
Weekly	46	30.9
Daily or almost daily	57	38.2
Total	**149**	**100**

4.4.3. Nutritional practices

This section assessed the nutritional practices of the participants as a risk factor as indicated below.

4.4.3.1 Number of meals eaten per day

Participants were assessed on eating and nutritional behavior as a contributory factor to overweight and obesity. Table 4.8 shows that a greater proportion of 74.9% of participants consume three meals per day, around 16.9% consume two meals a day while just a few of

6.1% consume four meals per day. This shows that most of the participants were not overeating.

Table 4. 8 Number of meals per day

Number of meals per day	n=295	Percentage
Once per day	4	1.7
Twice per day	50	16.9
Thrice per day	221	74.9
Four times per day	18	6.1
More than four times per day	1	0.3
Total	295	100

4.4.3.2 Snacking between meals

Participants were assessed on snacking patterns. It is clear that participants were snacking and most of them were snacking with fatty foods, resulting in weight gain. Table 4.9 illustrates that most participants (60.3%) consume snacks between meals, while a minority of 6.1% did not eat snacks between meals. Of those who consume snacks, a considerably 39.7% consume potato chips, 20.9% consume yoghurt, 22.4% consume fruits, a least of 6.5% consume vegetables.

Table 4. 9 Snacks consumed between the meals

Snacking between meals	Frequency	Percentage
Do you snack between meals?		
Yes	178	60.3
No	18	6.1
Sometimes	99	33.6
Total	**295**	**100**
Types of snacks consumed		
Potato chips	110	39.7
Yoghurt	58	20.9
Fruits	62	22.4
Vegetables	18	6.5
All of the above	29	10.5
Total	**277**	**100**

4.4.3.3 Skipping of meals

Participants were asked whether they skipped meals or not. Table 4.10 demonstrates that a higher proportion of 80.3% of participants skipped meals, a lesser proportion of 5.1% did not skip meals, while just 14.6% reported that they sometimes skip meals. Skipping meals slows down metabolism and causes overeating thus resulting in overweight and obesity. The survey further probed the reasons for participants to skip meals and the table below also indicates the distribution of their distinguished responses. Nearly two thirds of participants (65.8%) reported that they did not feel hungry, about 22.8% had no appetite whereas a minimum of 3.6% claimed they had no one who could cook for them.

Table 4. 10 Frequency of Skipped meals

Frequency of skipped meals	**N=295**	**Percentage**
Do you skip meals?		
Yes	237	80.3
No	15	5.1
Sometimes	43	14.6
Total	**295**	**100**
Reason for skipping meal		
No appetite	64	22.8
Don`t feel hungry	183	65.3
No one could cook for me	10	3.6
Lack of money to buy	0	0
Always busy working	20	7.1
Don't feel like eating alone	3	1.1
Total	**280**	**100**

4.4.3.4 Frequency of eating fast food per week

The survey assessed participants on their frequency of fast food consumption (restaurants or chines foods canteens) on a weekly basis. Table 4.11 shows that more participants (30.5%) ate fast food twice per week, followed by 22.0% who ate fast foods once a week, followed by just about 21.7% who ate fast foods three times a week. Furthermore, a mere 4.1% reported not to consume fast foods at all.

Table 4. 11 Frequency of eating fast food per week

Frequency of eating out per week	N=295	Percentage
Daily	3	1.0
Once per week	65	22.0
Twice per week	90	30.5
Three times per week	64	21.7
Four times per week	33	11.2
More than four times	28	9.5
Not at all	12	4.1
Total	**295**	**100**

4.4.3.5 Frequency of consuming fruits per week

The survey assessed participants on their frequency of consuming fruits on a weekly basis. Table 4.12 shows that a relatively lesser proportion of 3.1% consume fruits daily, 11.2% consume fruits once per week and 24.1% consume fruits twice per week. Moreover, 16.3 % consume fruits four times per week while about 12.9% consume fruits more than four times per week.

Table 4. 12 Frequency of consuming fruits per week

Frequency of consuming fruits per week	Frequency (n = 295)	Percentage
Daily	9	3.1
Once per week	33	11.2
Twice per week	71	24.1
Three times per week	91	30.8
Four times per week	48	16.3
More than four times per week	38	12.9
Not at all	5	1.7
Total	**295**	**100**

4.4.3.6 Frequency of eating protein-rich foods (Meat)

Participants were assessed in terms of frequency of fish, chicken, eggs and lean meat consumption. Findings as shown in Table 4.13 revealed that very few participants (5.1%) ate meat daily, 14.2% ate meat once a week, 15.6% ate meat twice per week while 29.8% ate

meat four times per week or more. Most participants (33.5%) reported consuming meat three times a day whereas only 1.8% did not eat meat.

Table 4. 13 Frequency of consuming fish, chicken, eggs and lean meat per week.

Frequency of Fish, Chicken, Eggs, Lean meat consumed weekly	Frequency	Percentage
Daily	15	5.1
Once per week	42	14.2
Twice per week	46	15.6
Three times per week	99	33.5
Four time per week	54	18.3
More than four times per week	34	11.5
Not at all	5	1.8
Total	**295**	**100**

4.4.3.7 Frequency of consuming beans

Participants were assessed on how frequently they consumed beans on a weekly basis. Beans are good sources of fiber which help to protect against high cholesterol, digestive illness and heart disease. Findings indicated that those who consume beans daily were relatively fewer (1.1%) followed by just 16.9% who consume beans once per week, followed by 17.3% who consume beans four times per week, followed by nearly a quarter (25.4%) who consume beans three times per week (Table 4.14).

Table 4. 14 Frequency of beans consumed per week.

Frequency of beans consumed per week	Frequency	Percentage
Daily	3	1.1
Once per week	50	16.9
Twice per week	84	28.5
Three times or more	75	25.4
Four times per week	51	17.3
More than four times per week	19	6.4
Not at all	13	4.4
Total	**295**	**100**

4.4.3.8 Frequency of consuming processed foods

Participants were assessed on the survey on how often they consumed processed foods in a week. Table 4.15 shows that only a minimum of 1.7% of the participants did not consume

processed foods at all whereas a maximum of 97.4% consumed processed foods on different occasions at a weekly basis.

Table 4. 15 Frequency of consuming processed food per week.

Frequency of consuming processed food	Frequency	Percentage
Daily	3	1.1
Once per week	31	10.5
Twice per week	58	19.7
Three times per week	84	28.5
Four times per week	67	22.7
More than four times per week	44	14.9
Not at all	5	1.7
Total	**295**	**100**

4.4.3.9 Frequency of eating milk/ yoghurt

Participants were asked about their frequency of milk and milk products consumption. Milk is a great source of protein which helps in maintaining a healthy weight. The findings revealed that more than a quarter (28.9%) of participants consume milk and milk products three times per week followed by almost a third (32.2%) who consume milk and/or dairy products twice per week. Only a few (2.4%) did not consume them at all (Table 4.16).

Table 4. 16 Frequency of milk or yoghurt consumption

Frequency of milk or yoghurt	Frequency	Percentage
Daily	7	2.4
Once per week	38	12.9
Twice per week	95	32.2
Three times per week	86	28.9
Four times per week	38	12.9
More than four times per week	24	8.3
Not at all	7	2.4
Total	**295**	**100**

4.4.3.10 Frequency of drinking soft drinks, juice and energized drinks

Participants were asked about their frequency of drinking fizzy drinks. Table 4.17 shows that only 6.1% of the participants drink soft drinks, juice or energized drinks daily, 13.6% drink soft

drinks, juice or energized drink once per week, 24.4% drink soft drinks, juice or energized drink twice per week, 27.8 % drink soft drinks, juice or energized drink three times per week, 22.7% drink soft drinks, juice or energized drink four times per week, only 3.4% drink soft drinks, juice or energized drink more than four times per week, while a mere 2.0% did not drink soft drinks, juice or energized drink at all. Furthermore, less than half of the participants (43.4%) indicated that they sometimes drink water after meals, about 38.9% drink water after every meal, while just 17.6% do not drink water after meals.

Table 4. 17 Frequency of drinking Soft drinks, juice and energized drinks per week

Frequency of drinking soft drinks, juice and energized drinks per week	Frequency	Percentage
How often do you drink fizzy drinks in a week?		
Daily	18	6.1
Once per week	40	13.6
Twice per week	72	24.4
Three times per week	82	27.8
Four times per week	67	22.7
More than four times per week	10	3.4
Not at all	6	2.0
Total	**295**	**100**
Do you drink water after every meal?		
Yes	115	**38.9**
No	52	**17.6**
Sometimes	**128**	**43.4**
Total	**295**	**100**

4.4.4. Physical Activity

Participants were assessed on routine physical activities or exercise participation namely: vigorous intensity physical activities, moderate physical activities and sedentary behaviour. Exercise helps to burn calories thus preventing weight gain.

4.4.4.1 Engagement in vigorous physical activities

Participants were asked if they participated in any vigorous-intensity activity that continuously causes large increases in breathing or heart rate (like sprinting, jogging, carrying or lifting heavy loads, digging, and construction at home) for at least 10 minutes. Table 4.18 shows that a larger population of the participants (65.4%) did not participate in vigorous activity while 34.6% participated in vigorous-intensity activities such as sprinting, jogging, carrying or lifting

loads and construction at home for at least 10 minutes continuously. From those who participate in vigorous activity, only 24.5% of the participants engaged in vigorous activities once or twice per week, a remarkably 71.6% engaged three to five times per week, and a lesser proportion of 3.9% engaged more than five times per week. In addition, more than half (58.8%) of the participants engage in vigorous activity for 10 to 30 minutes, just 6.8% engage in vigorous activity for an hour while about 15.7% engage in vigorous activity for less than 10 minutes.

Table 4. 18 Engagement in vigorous activities

Currently engaging in vigorous activities	Frequency	Percentage
Yes	102	34.6
No	193	65.4
Total	**295**	**100**
Number of days engaged in a week		
Once-twice a week	25	24.5
Three-five times a week	73	71.6
More than five times	4	3.9
Total	**102**	**100**
Duration on vigorous activities		
Less than ten minutes	16	15.7
Ten-thirty minutes	60	58.8
Thirty-fifty nine minutes	18	17.6
One hour	7	6.8
More than 1 hour	1	0.9
Total	**102**	**100**

4.4.4.2 Engagement in moderate physical activity

In the survey, participants were also asked if they participated in any mode of moderate-intensity physical activity that causes small increases in the breathing or heart rate such as brisk walking (or carrying a light load) for at least 10 min continuously. Table 4.19 shows that a total of 59.7% engaged in moderate-intensity activity whilst those who did not engage in any moderate-intensity activity amounted to 40.3%. From those who participated in moderate to intensity activity, a majority of 69.3% of the participants engaged in moderate activity for at least 3 to 5 days a week while just 27.3% engage for at least more than 5 days a week. In addition, about 40.9% of the participants spent 30 to 59 minutes in activity, 33.5% spent at least one hour whereas only 2.3% spent less than ten minutes.

Table 4. 19 Engagement in moderate activities

Currently engaging in moderate activities	Frequency	Percentage
Yes	176	59.7
No	119	40.3
Total	**295**	**100**
Number of days engaged/week		
Once-twice a week	6	3.4
Three-five times in a week	122	69.3
More than five times in a week	48	27.3
Total	**176**	**100**
Time spent on vigorous activities		
Less than 10 minutes	4	2.3
Ten-thirty minutes	39	22.2
Thirty-fifty nine minutes	72	40.9
One hour	59	33.5
More than 1 hour	2	1.2
Total	**176**	**100**

4.4.4.3 Time spent sitting in a day

The survey also assessed participants on the amount of time they spend sitting or reclining at work, at home, getting to and from work places sitting in a car or bus. Sedentary behaviour doubles the risk of obesity, CVDs and diabetes. Table 4.20 shows that nearly half (49.5%) of the participants spend more than 10 hours sitting daily, 33.6% spend 8 to 10 hours sitting daily while a lower proportion of 4.7% did not know the number of hours they spend sitting on a typical day.

Table 4. 20 Time spent on sitting in a day

Time spent on sitting in a day	Frequency	Percentage
Thirty minutes-three hours	2	0.7
Four-five hours	5	1.7
Five –eight hours	29	9.8
Eight-ten hours	99	33.6
More than ten hours	146	49.5
Don’t know	14	4.7
Total	**295**	**100**

4.5 Blood pressure, glucose level and family history of overweight/obesity

The survey also assessed participants on whether they have a known history of raised blood pressure, diabetes, and family history of overweight/obesity.

4.5.1 History of raised blood pressure and glucose level

The findings in the survey as shown in Table 4.21 reveal that majority of participants (96.6%) claimed that they have a history of blood pressure test while a greater proportion of 93.2% claimed they had a history of blood glucose measured by doctor or any other health worker. Ultimately, fewer participants of 3.4% and 6.8% respectively had no history of blood pressure and blood glucose measured by a doctor or any other health worker. Also, among those tested for diabetes, just 18.9% of participants have been diagnosed with diabetes mellitus, while a major 81.1% of the participants were not diagnosed with diabetes mellitus. Lastly, the table demonstrates the responses of those who were diagnosed with diabetes when asked how they managed it, less than half (48.1%) indicated that they modified their lifestyle while more than half (51.9%) stated that they are on medication.

Table 4. 21 History of raised blood pressure and elevated sugar level among study participants

History of high blood pressure	**Frequency**	**Percentage**
Yes	285	96.6
No	10	3.4
Total	**295**	**100**
Diagnosis with high blood pressure		
Yes	86	29.2
No	209	70.7
Total	**285**	**100**
On medication for high blood pressure		
Yes	78	90.7
No	8	9.3
Total	**86**	**100**
History of elevated blood sugar	**Frequency**	**Percentage**
Yes	275	93.2
No	2O	6.8
Total	**295**	**100**
Diagnosis with high sugar/diabetes		
Yes	52	**18.9**
No	223	**81.1**
Total	275	**100**
Management of blood sugar/diabetes		
Lifestyle changes	25	48.1
Medication	27	51.9
Total	**52**	**100**

4.5.2 Family history of overweight/obesity

Participants were also asked whether they have a first-degree relative who is overweight and obese and to specify which relative is overweight/ obese.

4.5.2.1 Availability of a relative who is overweight/ obese

Figure 4.1 illustrates that a majority of 69.2% of participants agreed to having a blood relative who is either overweight or obese compared to a considerably 30.8% who denied having an overweight or obese close relative.

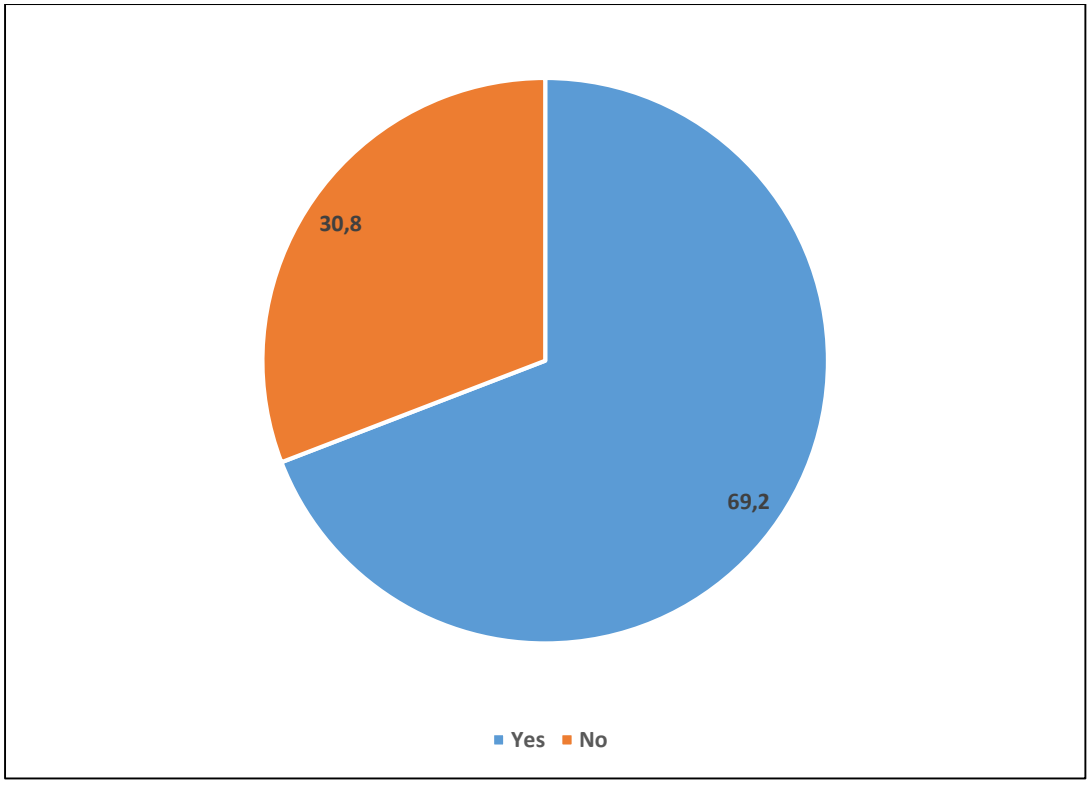

Figure 4. 1 Family history of overweight and obesity (n=295)

4.5.2.2 Specification of the exact adult who is overweight/ obese

Amongst participants who agreed to having a family history of overweight or obesity. Figure 4.2 below shows that a less proportion of 6.9% stated that they have a maternal grandfather who is overweight/obese, about 10.9% stated that they have a paternal grandmother who is overweight/obese while around 11.9% identified their mothers as either overweight/obese. In addition, a total of 14.4% identified their fathers as overweight/ obese relatives while just 15.3% identified their sisters as overweight/obese.

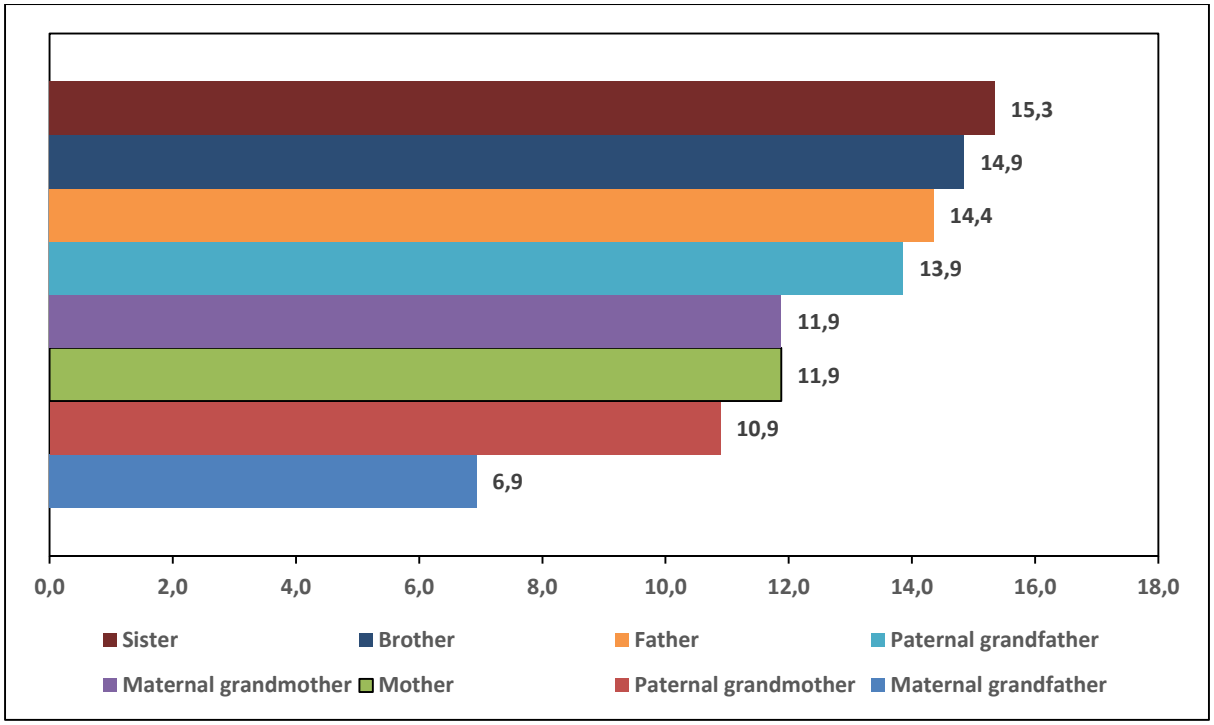

Figure 4. 2 Relatives who are overweight/obese

4.6 Anthropometric status

In this study, objective one was to assess anthropometric status (BMI, percentage body fat, and waist to hip ratio) of educators in Nkomazi local Municipality, Ehlanzeni District, Mpumalanga Province. Anthropometry provides the single most inexpensive and non-invasive means of assessing overweight and obesity.

4.6.1 Body mass index (BMI)

Participants measured their weight and height which were used to determine their BMI. Figure 4.3 below shows participants' total body mass index according to six classifications [underweight, normal, overweight, obesity 1, obesity 2 and obesity 3]. One third of participants (33.2%) were classified as of normal weight, a sum of 33.9% were classified as overweight, about 30.9% were classified as obese while only 2% were classified as underweight.

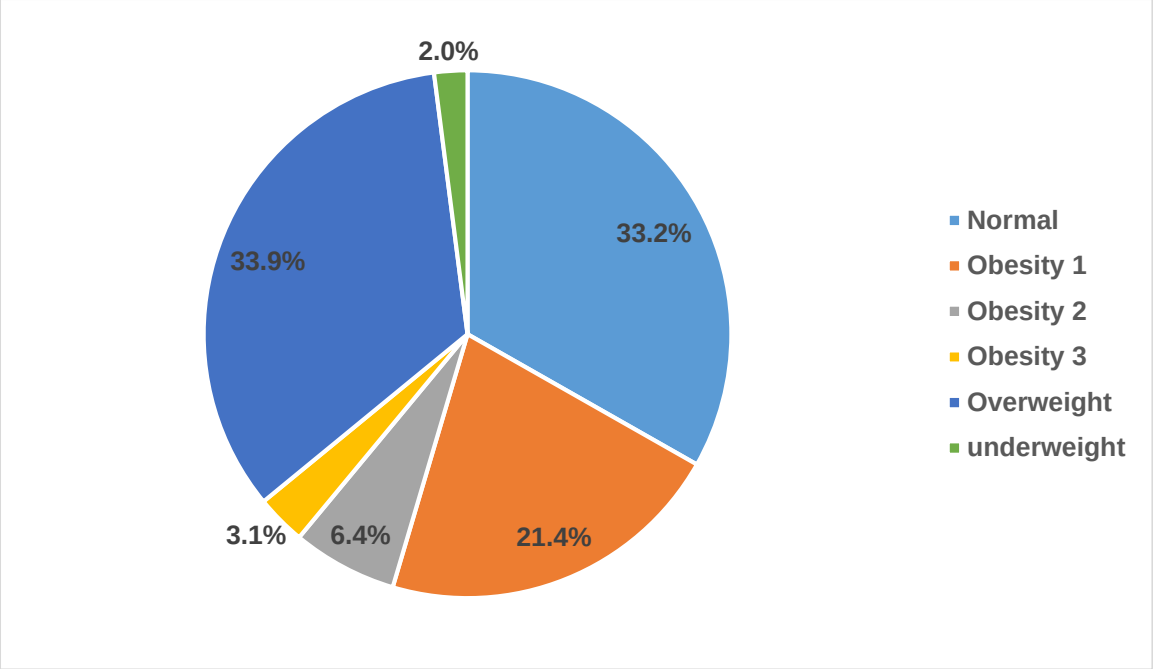

Figure 4. 3 Total Body Mass Index (BMI)

4.6.1.1 Total BMI based on gender

According to the figure below, there were slight gender differences (p=0.061), especially for obesity 1 and obesity 2 classification. However, most male participants were of normal body weight (34.4 %) and had less obesity 3 (1.5%) than female participants with normal weight at a proportion of 32.3 % and obesity 3 at only 3.7 % respectively.

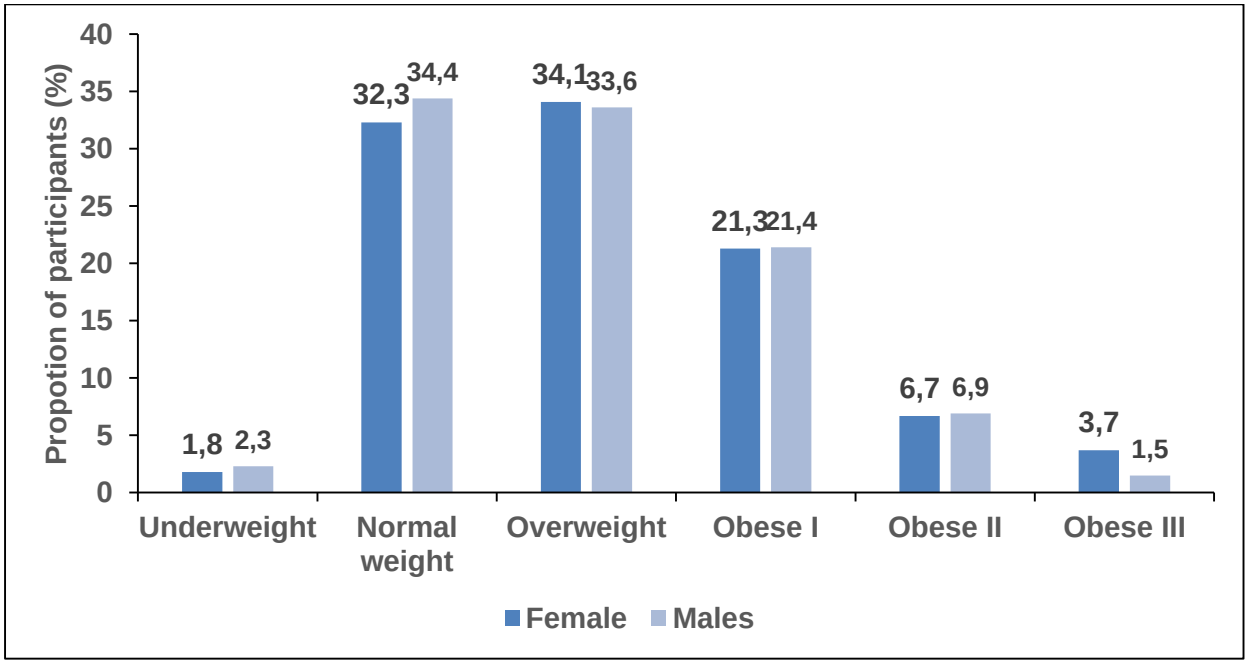

Figure 4. 4 BMI based on gender

4.6.1.2 BMI based on age groups

Among age groups (Figure 4.5), those who were aged 18-24 years and 25-34 years contributed largely to normal BMI category (60.8% and 52.7%), respectively. Obesity 1 category was dominated by those aged 35-44 years (46,4%) while those over 55 years dominated obesity 2 category (22.5%) and obesity 3 category (10%).

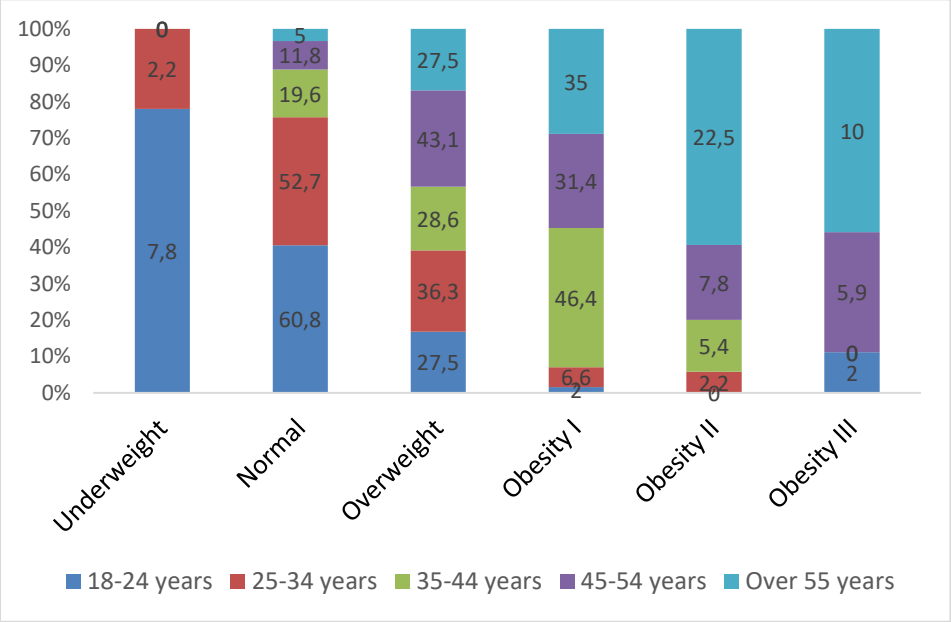

Figure 4. 5 BMI of participants according to age groups

4.6.2 Total body fat

Participants were measured on various skinfold sites and results were used to compute % body fat.

4.6.2.1 Total body fat percentage based on gender

Table 4.22 indicates that minority of the female participants (1.8%) had athletic body fats% (8-15%) while about 32.3% had good body fats% (16-23%). Moreover, about 34.1% female participants had acceptable body fats (24-30%) while just 21.3% had overweight body fats% (31-36%). On the other hand, a minority of 2.3% male participants had athletic body fats (5-10%) while about 34.4% had good body fat (11-14%). Furthermore, a group of around 33.6% of male participants had acceptable body fats (15-20%) whilst just 21.4% had overweight body fats (21-24%).

Table 4. 22 Total body fat percentage for females and males

%Body fat classification	Body Fat%(Female)	Body fat %(male)	Frequency (Female)	%	Frequency (Male)	%
Athletic	8-15	5-10	3	1.8	3	2.3
Good	16-23	11-14	53	32.3	45	34.4
Acceptable	24-30	15-20	56	34.1	44	33.6
Overweight	31-36	21-24	35	21.3	28	21.4
Obese	≥37	≥25	17	10.4	11	6.9
Total			164	100	131	100

4.6.3 Waist to hip ratio

Participants measured their waist and hip circumferences which were used to determine waist to hip ratio. Table 4.23 shows that 26.2% of the female participants had an excellent waist to hip ratio (<75), 18.3% had good waist to hip ratio (0.75-0.79), a majority of 33.5% had average waist to hip ratio (0.80-0.86) while just 21.9% were at risk (≥0.86).

Table 4. 23 Waist-hip ratio for female educators

Score	Interpretation	Frequency	Percentages
<0.75	Excellent	43	26.2
0.75-0.79	Good	30	18.3
0.80-0.86	Average	55	33.5
≥ 0.86	At Risk	36	21.9
Total		**164**	**100**

Amongst male participants, the findings in Table 4.24 below show that a sum of 24.4% had excellent waist to hip ratio (<0.85), about 16.8% had good waist to hip ratio (0.85-0.89), over 34.4% had average waist to hip ratio (0.90-0.95) while another 24.4% were at risk (≥0.95).

Table 4. 24 Waist-hip ratio for male educators

Score	Interpretation	Frequency	Percentages
<0.85	Excellent	32	24.4
0.85-0.89	Good	22	16.8
0.90-0.95	Average	45	34.4
≥ 0.95	At Risk	32	24.4
Total		**131**	**100**

4.7 Clinical measurements

The third objective of the study was to assess blood pressure and blood glucose among educators in Nkomazi Local Municipality, Ehlanzeni District, Mpumalanga Province. Participants were measured BP and glucose in the survey.

4.7.1 Blood pressure results of educators

Regarding systolic and diastolic blood pressure, more than half of female participants (56.1%) had normal blood pressure, more than a quarter (26.2%) were pre-hypertensive, 10.9% were stage 1 hypertensive, just 5.5% were stage 2 hypertensive while a minority of 1.3% were having a hypertension crisis. Moreover, nearly half of the male participants (46.5%) were normal, 33.6% were pre-hypertensive and lastly, relatively few (1.5%) were having a hypertension crisis as shown in Table 4.25 below.

Table 4. 25 Systolic blood pressure results of male and female educators

BP Class	Interpretation	Total population		Females		Males	
		Frequency	%	Frequency	%	Frequency	%
≤120	Normal	153	51.8	92	56.1	61	46.5
120-139	Pre-hypertension	87	29.5	43	26.2	44	33.6
140-159	Stage 1 hypertension	34	11.5	18	10.9	16	12.2
≥160	Stage 2 hypertension	17	5.7	9	5.5	8	6.1
≥ 180	High blood pressure crisis	4	1.36	2	1.3	2	1.5
Total		**295**	**100**	**164**	**100**	**131**	**100**

Diastolic blood pressure results revealed that about 58.6% were considered normal while those with at stage 2 hypertension constituted 7.1% of the participants (Table 4.26). Similarly, to systolic results of females were the majority in all categories.

Table 4. 26 Diastolic blood pressure

BP Class	Interpretation	Total population		Females		Males	
		Frequency	%	Frequency	%	Frequency	%
≤80	Normal	173	58.6	116	70.7	57	43.5
81-89	Pre-hypertension	61	20.7	31	18.9	30	22.9
90-99	Stage 1 hypertension	50	16.9	24	14.6	26	19.8
100 -119	Stage 2 hypertension	21	7.1	9	5.5	12	9.2
≥120	High blood pressure crisis	0	0	0	0	0	0
Total		**295**	**100**	**164**	**100**	**131**	**100**

4.7.2 Glucose level of educators

Participants measured their glucose level in the survey. The findings in Table 4.27 indicate that 34.7% of the female participants had normal glucose level, 39.1% had high risk level, and 26.2% had very high risk level. Nearly one third of male participants (30.5%) had normal glucose level, almost half (44.3%) had high risk level while over a quarter (25.2%) had a very high risk level.

Table 4. 27 Glucose level of male and female educators

Glucose values	Interpretation	Total population		Females		Males	
		Frequency	%	Frequency	%	Frequency	%
≤3.9-5.5	Normal	97	32.9	57	34.7	40	30.5
5.6-7.0	High risk	122	41.4	64	39.1	58	44.3
≥7.0	Very high risk	76	25.7	43	26.2	33	25.2
Total		**295**	**100**	**164**	**100**	**131**	**100**

4.8 Correlations of anthropometric status and lifestyle risk factors associated with overweight and obesity

The chi-square test was used to test the association between some lifestyle variables and anthropometric status. As shown in table 4.28, family history was significantly associated with BMI (p-value = 0.001) and WHR (p-value of 0.026). This observation was the same for routine physical exercise which also showed a significant association with both BMI (p-value = 0.002)

and WHR (p-value = 0.050), respectively. The number of meals consumed per day also show significant association with HWR (p-value = 0.028), but not significantly associated with BMI. In this study, smoking and alcohol consumption didn't show a statistically significant association with both BMI (p=0.721) and WHR (p=0.860) scores.

One-way analysis of variance (ANOVA) was used to confirm the differences in the BMI and WHR mean score between the distinguished groups. The mean BMI and WHR score of participants with family obesity history was significantly higher than that of those without family overweight/obesity history. For physical exercise factor, the mean BMI and WHR score was significantly higher for participants who do not engage on routine physical exercise compared to those involved in physical exercise at least 3 days a week.

Table 4. 28 Association between lifestyle behaviours and anthropometric status (p = ≤ 0.05)

Independent variables	BMI (P-value)	WHR (P-value)
Alcohol consumption	0.721	0.860
Smoking	0.151	0.186
Family history for overweight/obesity	0.001**	0.026*
Engagement on routine physical exercise for at least 3 days a week	0.002**	0.050*
Number of meals per day	0.465	0.028*

** = highly significant (P< 0.01)

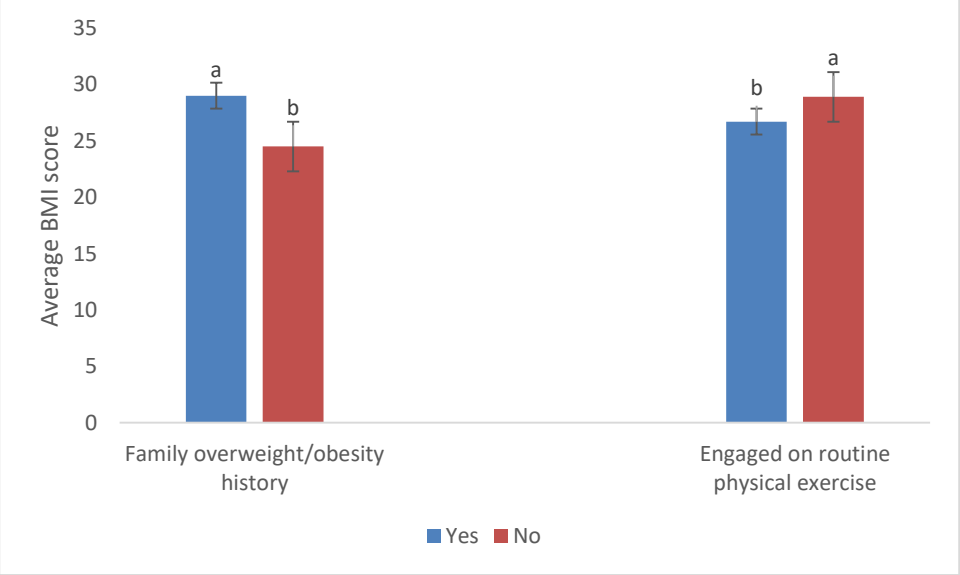

Figure 4. 6 Mean BMI score of participants according to family history status and involvement on routine physical exercise (P ≤ 0.05)

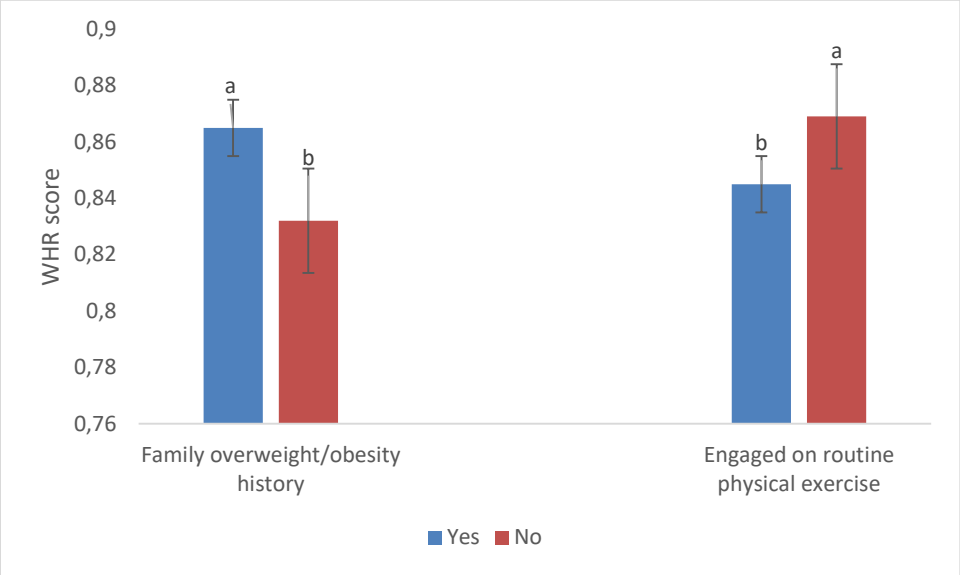

Figure 4. 7 Mean BMI score of participants according to family history status and involvement on routine physical exercise (P ≤ 0.05)

4.8 Association of anthropometric and clinical measurement

The correlation of coefficient analysis showed positive relationship between anthropometric (body mass index and waist-hip ratio) and clinical measurements (blood pressure and blood glucose level). As shown in Table 4.29, the analysis suggests that it is likely that the increase in body mass index score also indicates low to moderate increase in blood pressure and blood glucose level. For blood pressure and blood glucose level, the correlation value was 0.562 which indicates good positive relationship between the two variables as shown in Table 4.30.

Table 4. 29 Coefficient of linear correlation between the anthropometric and clinical measurement of educator participants in Nkomazi Municipality, Mpumalanga Province

	BMI	WHR	BP	BGL
BMI	1.00	0.225	0.383	0.398
WHR		1.00	0.218	0.245
BP			1.00	0.562
BGL				1.00

BMI = Body Mass Index; BGL = Blood Glucose Level; WHR = Waist – Hip Ratio; BP = Blood Pressure.

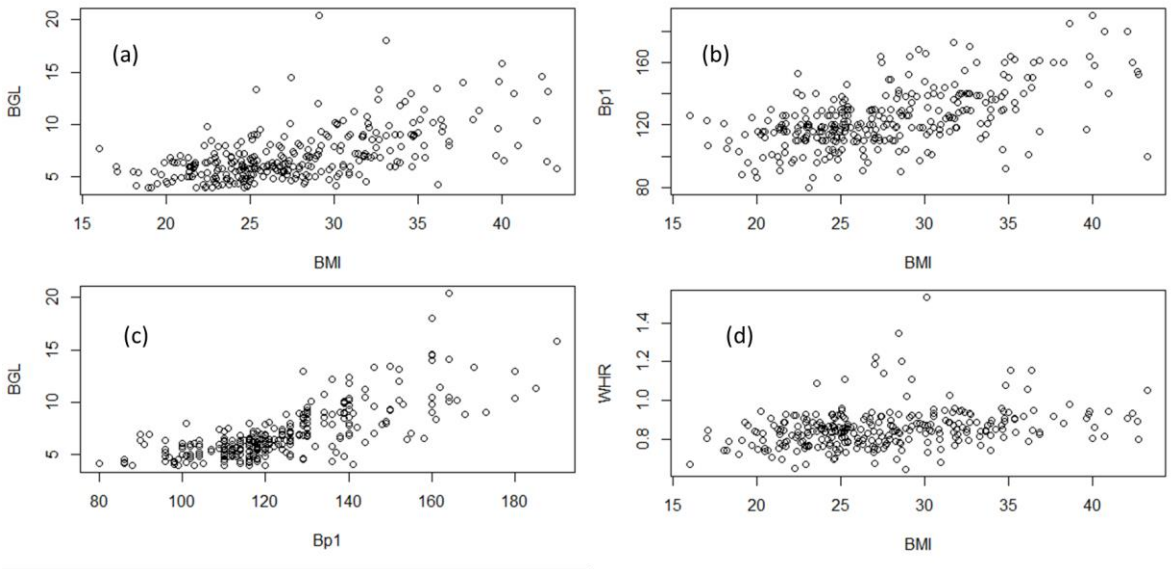

Figure 4.8 Score plots showing Coefficient of linear correlation for (a) Body mass index v/s Blood glucose level (b) Body mass index v/s Systolic blood pressure (c) Blood glucose level v/s systolic blood pressure and (d) Body mass index v/s Waist – hip ratio.

4.9 Chapter Summary

This chapter was a presentation of the findings. Moreover, overweight and obesity were prevalent among educators. Overweight and obesity were associated with unhealthy lifestyle habits such as smoking, over consumption of alcohol, unhealthy nutritional practices and lack of participation on physical activities. Consequently, teachers who were overweight or obese were also likely to be hypertensive, diabetic or both. The following chapter discusses the findings.

CHAPTER 5

DISCUSSIONS

5.1 Introduction

This chapter presents a discussion of the findings of this study compared with other previous studies. The study aimed to investigate the prevalence and associated health risk factors of overweight and obesity among educators in the Nkomazi Municipality, Ehlanzeni District, Mpumalanga Province. Overweight and obesity are growing public health concerns and they are major causes of increased morbidity and mortality rates globally. The findings are discussed under the following subheadings: prevalence of overweight and obesity, associated health risk factors, clinical measurements and association between risk factors and anthropometric measurements.

5.2 Prevalence of overweight and obesity among educators

The findings revealed that as many as 33.9% were overweight whereas a maximum of 30.9% of male and female participants were obese. These are consistent with the results from previous studies that discovered that a considerable average of participants was overweight (Lee *et al*., 2019). This study found that only 33.2% had normal body weight while a minority of 2.0% were underweight. A previous study made a similar observation where very few participants were underweight while the vast majority were of normal weight and overweight (Tapera *et al*., 2017; Al-Ghabhan, 2018). This poses a danger to their health as obese people are prone to many lifestyle conditions, which include high blood pressure, type 2 diabetes and high cholesterol amongst others (Vaneckova, Maletinska, Behuliak, Nagelova, Zicha & Kunes, 2014; Harikumar, Althaf, Kumar, Ramunaik & Survarna, 2013). In addition, Garg, Maurer, Reed and Selagamsetty (2014) survey which investigated the health risks associated with obesity found a major 33% incidence of cancer among obese participants (25% high among men and 37% higher among women). The obese patients also posed an increased risk of Hodgkin`s disease (Garg, Maurer, Reed & Selagamsetty, 2014).

BMI and WHR are important criteria in the clinical determination of obesity (Bala & Meenakshi, 2019). WHR helps to predict one`s risk for heart diseases and diabetes independent of BMI (Nowbar, Gitto, Howard, Francis, & Al-Lamee, 2019). A few studies suggested that WHR is more accurate than BMI for predicting risks for cardiovascular diseases and premature death (Menekse & Balci, 2017). However, an increased BMI poses a risk for developing ischemic stroke, hypertension and breathing problems (Nowbar, Gitto, Howard, Francis, & Al-Lamee, 2019). The Findings in this study show that almost a quarter (24.4%) of males had an excellent waist to hip ratio whereas more than a quarter (26.2%) of their female counterparts had an excellent WHR. Moreover, about 21.0% of the women were categorized to be at risk whilst

nearly a quarter (24.4%) of the male participants were at risk. These results are similar to those of a study by Ahmad, Adam, Nawi, Hassan and Ghazi (2016) where the female participants showed a higher prevalence of abdominal obesity than the male participants. In addition, Hoffmann (2013) stated that about 34% of the women were overweight while more than a quarter (27%) were found to be obese with around 17.8% who were centrally-obese.

There was a strong positive correlation between BMI and WHR with age. This means that as women aged, both BMI and WHR increased. According to WHO (2011) this might be due to menopause which is also associated with an increase in fat mass, and a redistribution of fat to the abdominal area. The overweight and obesity pandemic continues to rise in SA despite current existing interventions. Overweight/obese individuals are more likely to suffer quite a number of potentially serious health problems including heart disease and premature death.

5.3 Lifestyle Risk Factors

Lifestyle-related factors are the major influence of overweight and obesity. These lifestyle habits include smoking, high alcohol consumption, poor nutritional practices, lack of physical activity and sedentary behavior which are discussed below.

5.3.1 Smoking

Smoking may affect health negatively as most people who smoke cigarettes end up with cancer of the lungs and respiratory problems (Bonnie, Stratton & Kwan, 2015). In the study conducted in Australia, as many as 40% of the participants smoked cigarette (Nguyen, Bauman & Ding, 2019). However, in the current study a considerably 19.6% of the participants reported to be smoking. Even though most participants in the current study did not smoke, it is still cause of concern as smoking affects the health of the person smoking and the people around.

Similarly, a survey conducted among teachers in Botswana revealed a relatively low prevalence of smoking among participants. Only 3.2% reported being current smokers, 5.3% were ex-smokers, and 91.5% had never smoked (Erick & Smith, 2013). This further concur with findings from Malaysian teachers where only 7.8% were smoking and quite similar results were reported in a study from Bahrain teachers in which just 8.7% were smoking (Al-Naggar, Jawad & Bobryshev 2012; Annadurai, 2018). Moreover, smoking was more prevalent among the male (10.8%) compared to the female participants (0.4%) respectively (Eric & Smith, 2018).

Likewise, the prevalence of smoking was reported to be at 17% among secondary school teachers in Bangladesh (Rahman *et al*., 2011). Much higher prevalence was reported in a study from Nepal which revealed that a majority of 57.1% of the school teachers used any

form of tobacco (Rocha *et al*., 2015). Ultimately, factors such as school level, marital status and BMI were found to be positively associated with cigarette smoking whilst age, duration of employment and total weekly hours worked showed a negative association (Rahman *et al*., 2011; Eric & Smith, 2018).

5.3.2 Alcohol consumption

The current South African food based dietary guidelines (FBDGs) state that "if you drink, drink sensibly". Even though alcohol is mainly used by as an economic activity in SA, misuse of it is associated with many comorbidities. According to Global Burden of Disease (GBD) 2015 Risk Factors Collaborators (2016) alcohol consumption is among the top five risk factors for the growing global non-communicable diseases burden and is a part of the key parts of the WHO goals to reduce NCDs by 25% by 2025. Consequences of high alcohol consumption include social fabric of society through incidence of abuse and gender based violence, vehicle accidents, crime, absenteeism from work and low productivity at work. (HSRC, 2019). In addition, this survey also reported that Ehlanzeni district had the highest proportion of participants spending more than R1000.00 on alcohol per month whilst a greater proportion claimed that they spend significant sums on alcohol-related medical expenses (HSRC, 2019).

More than half of the participants did drink alcoholic beverages while 43.7% never had alcoholic beverages. In addition, in the current study about 11.4% of participants would drink more than 10 drinks per session (binge drinking). In South Africa, the biggest challenge is binge drinking. On the contrary, a varied observation was done in Thailand where the majority (76.2%) of the participants reported they did not consume alcohol at all (Pengpid & Peltzer, 2015).

5.3.3 Nutritional practices

The WHO has stipulated the importance of diet as a way to reduce obesity and overweight which are risk factors of many NCDs (WHO, 2018). Unhealthy eating can either be eating habits that do not fulfill the body's requirements due to deficient diet or excessive diet, which results in weight gain, low energy levels, and poor general health overtime (Ogden *et al*., 2016). It is recommended that people should eat at least three meals per day and snacks in between meals (El Ansari, Suominen & Samara, 2015). Skipping meals will lead to hunger and this will make people to make unhealthy choices because they will only eat what is accessible to them (Paoli *et al*., 2019). In this study, a greater majority of 80% of the participants agreed to sometimes skip meals with some of 28.1% relating it to poor appetite whilst a considerable 36.1% gave reasons for not being hungry whilst a sum of 29.3% skipped due to a previous bigger meal.

In support of these findings are those by Eze, Maduabum, Onyeke, Anyaegunam, Ayogu, Ezeanwu, and Eseadi (2017) which reported that participants would sometimes skip meals, buy snacks to eat as lunch, eat in between meals, and would buy food from fast foods outlets. In the current study, three quarter of participants consumes fast foods less than three times per week. Regular consumption of fast-food has been associated with weight gain, obesity, type 2 diabetes, and coronary artery disease (Bahadoran, Mirmiran & Azizi, 2015). Al-Rethaiaa, Fahmy and Alshwaiyat (2010) reported that overweight and obesity could also be attributed to overeating, eating high energy dense foods, big portion size, and skipping meals.

The FBDGs recommend that schoolchildren and adults consume at least 400 g (five portions) of diverse fruits and vegetables daily (Naude, 2013). Adequate consumption of fruits helps to reduce the risk of NCDs (Naude, 2013). In South Africa, the burden of nutrition-related public health problems has doubled over the past five years (Popkin, Corvalan & Grummer-Strawn, 2020). This double burden is characterized by persistent food and nutrition insecurity, resulting in stunting among children, wasting, hidden hunger, underweight, and childhood and adult obesity (Naude, 2013). Many South Africans do not have sufficient variety of fruits and vegetables in their diets thus leading to the high prevalence of micronutrient deficiency (Labadarios, Steyn & Nel, 2011).

In the current study, very few participants consume fruits daily. Similar results were reported in a multi-national study where over 80% of participants from low-middle income countries did not meet the recommended intake of fruits and vegetables (Frank, Webster, McKenzie, Geldsetzer, Manne-Goehle, Andall-Brereton, Houehanou, Houinato, Gurung, Bicaba & McClure, 2019). Furthermore, this study revealed that a majority (60.3%) of the respondents consumed snacks with high energy dense while more than a quarter (28.5%) of the participants consumed processed foods three to five times per week. This concurs with results from a study conducted by Monica and John (2018) where there was a significant relationship between junk food consumption and obesity among the teacher participants. In accordance to a study conducted in Ghana, their participants were predominantly traders which predisposed them to inappropriate diets and meal patterns (Colecraft, Asante, Christian & Adu-Afarwuah, 2018). In the same study, it was discovered that most of the participants were of low-income level which also influences their unhealthy dietary choices.

According to Moubarac, Martins, Claro, Levy, Cannon and Monteiro (2013), over consumption of processed foods is a significant cause of overweight and obesity and the rapid rise of related chronic diseases, especially in lower-income countries. This is because processed foods are high in cholesterol and added sugar. A study done in Canada among Eeyouch adults by Lavigne-Robichaud Moubarac, Lantagne-Lopez, Johnson-Down, Batal, Sidi, and Lucas

(2018) reported that consumption of ultra-processed food was associated with an increased likelihood of having metabolic syndrome, low HDL, cholesterol and elevated fasting plasma glucose. In the current study, majority of the participants consumed processed foods four times or more per week. Similar observations were made by Abraham, Noriega, and Shin (2018) where they reported that more than half of the participants consume ultra-processed food daily because they are ready to eat or easy to prepare.

5.3.4 Physical activity

Flegal, Carroll and Ogden (2016) stated that even though the benefits of physical activity have been documented worldwide, more than half of adults do not engage in regular physical activity. The current study results show that above half of the participants did not engage in any form of vigorous activity. Statistics South Africa (2016) reported a similar finding, where it was estimated that 46% of South Africans did not meet the required 30 minutes of exercise for 3-5 days per week. From those who participate in vigorous activity, a sum of 71.6% participated in these activities between 3 to 5 days per week. Participation in vigorous-intensity physical activity is another key indicator of physical activity levels that has well-established health benefits recognized in 2010 WHO global recommendations on physical activity for health (Lancet Physical Activity Series Working Group, 2012).

To promote and maintain health, all healthy adults aged 18 to 65 years need moderate-intensity aerobic (endurance) physical activity for a minimum of 30 min on five days each week or vigorous-intensity aerobic physical activity for a minimum of 20 min on three days each week (Haskell, Lee, Pate, Powell, Blair, Franklin, Macera, Heath, Thompson & Bauman, 2007). In the current survey, about 22.2% of the active participants took 10 to 30 minutes in each activity, only 1.2% of the participants took more than an hour to complete the activities whereas relatively fewer (2.3%) of the participants took less than 10 minutes in each vigorous activity. According to Piercy, Troiano, Ballard, Carlson, Fulton, Galuska, George and Olson (2018), adults should do at least 150 minutes to 300 minutes a week of moderate-intensity, or 75 minutes to 150 minutes a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. They should also do muscle-strengthening activities on two or more days a week. Older adults should do multicomponent physical activity that includes balance training as well as aerobic and muscle-strengthening activities.

The Physical Activity Guidelines for Americans recommend that adults obtain at least 150 minutes/week of moderate-intensity physical activity, 75 minutes/week of vigorous-intensity physical activity, or a combination of moderate and vigorous physical activity (Tucker, Welk & Beyler, 2011). The participants in this study were within the stipulated recommendations as

the findings of this study indicate that more than half of the participants were participating in moderate activities and over 69.3% of these participants participated in these activities 3 to 5 times a week.

5.3.5 Sedentary behaviour

The literature revealed that an estimated 67% of adults reported sitting for more than eight hours per day, and only 28% to 34% of adults ages 65-74 are physically active (Department of Health and Human Services, 2017). Sedentary behaviour, obesity and smoking are significant risk factors for type 2 diabetes, cardiovascular diseases and many other lifestyles related NCDs (Bertoglia, Gormaz, Libuy, Sanhueza, Gajardo, Srur, Wallbaum and Erazo, 2017). In this study, however, a concerning discovery was noted on sedentary participants where more than 80% of the participants reported having been sedentary for eight hours and more per day. Cortes, Correa-Diaz, Benjumea-Arias, Valencia- Arias, and Piedrahita (2017) and Ziari *et al*. (2017) reported that high level of physical inactivity among participants in Colombia and Iran was due to lack of time, lack of support, lack of motivation, and lack of self-confidence, limited access to physical activity services and neglect benefits of physical activity. In this study. it was noted that the participants spent most of their time sitting due to work commitments.

5.4 Blood pressure and glucose levels

Being overweight/obese increases blood pressure because the heart needs to pump harder to supply blood to all body cells (Schutten *et al*., 2018). Therefore, excess fat makes it hard for the heart to pump blood adequately and it damages the kidneys, which help to regulate blood pressure (Grillo, Salvi, Coruzzi, Salvi & Parati, 2019). High blood pressure is the leading cause of strokes and other health problems such as high cholesterol, high glucose level, heart diseases and kidney failure (CDC, 2019). Chronic high blood pressure also contributes significantly to the early onset of Alzheimer`s diseases, dementia and atherosclerosis (Wanleenuwat, Iwanowski & Kozubski, 2019). Only 29.2% of the participants had been diagnosed with high blood pressure in the current study. The results of this study are similar to those discovered by Gul, Shehzad, and Zarif (2018) which highlighted that about 25.6% of the educators in that study were diagnosed with hypertension. These results are different from those discovered in Dhaka City which revealed that more than half of the teachers in the study were hypertensive (Barua, Noman, Mohammad & Hossain, 2019).

Furthermore, the study indicated that a greater proportion of 96.6% of the educators had their blood pressure checked by their doctor or any other health worker whilst a lower proportion of 3.4% had never been checked in the past. This is consistent with the results of a study that was looking at awareness of hypertension amongst teachers (Annadurai, 2018). Regular

health checks that include blood pressure and glucose monitoring which help to pick up early stages of lifestyle related diseases whereby treatment may be more successful (Nishigaki, Shimasaki, Yoshida & Hasebe, 2020). The American Heart Association (2016) recommends that people 40 years and below check their blood pressure at least every 2 years.

It is also recommended that hypertensive individuals must limit their salt intake to two grams per day, quit smoking and reduce alcohol consumption (Rust & Ekmekcioglu, 2016). The results indicate that more females had normal blood pressure than their male counterparts in the current study. Males mostly presented higher results for stage 1 and stage 2 hypertension compared to the female participants. However, both genders showed equal percentages under the prehypertension category. The results presented in this study are similar to those found by Mini, Sarma, Priya, and Thankappan (2020) which revealed that among the educators in that study, 53% had normal blood pressure, more than one fourth (29%) had pre-hypertension. Among the hypertensive, 34% had controlled hypertension, 53% had stage 1 and 13% had stage 2 hypertensions.

Type 2 diabetes is the most common type of diabetes that occurs due to family history, genes, low activity level, poor diet, and excess weight around the waist (Zheng, Ley & Hu, 2018). Being overweight/obese causes cells to change, thus making them resistant to the insulin hormone insulin carries sugar from the blood where it is used for energy (Afrin, 2016). High blood sugar is a major cause of heart coronary heart disease, stroke, amputation and blindness (Zheng, Ley & Hu, 2018). This study revealed that majority of 93.2% of the participants have had their blood sugar monitored by a health practitioner before whilst a minority of 9.3% had no history of blood glucose check-up.

Regular check-ups for blood tests, including glucose, cholesterol, and triglycerides, help reveal risks for multiple health problems, including heart disease (Wen, Huang, Lu & Yuan, 2019). The American Heart Association (2016) recommends that those who are over 45 years must do blood tests once in every 5 years and those who have a family history of heart diseases must be tested every year once they reach 40 years. In a study conducted in Ethiopia, the prevalence of hyperglycaemia increased with the increasing age group of 15–24 to 64 years (2.8% to 4.9%), about 0.5% of the study participants were reported as having diabetes on medication (Gebreyes, Goshu, Geletew, Argefa, Zemedu, Lemu, Waka, Mengesha, Degefu, Deghebo & Wubie, 2018). More than half (52%) of the hyperglycemic participants reported that they were on medication whilst the other participants had modified their lifestyles in this study.

5.5 Lifestyle risk factors and anthropometric measurements

The results in the current study indicated a statistical association between smoking and body fat percentage (p-value= 0.046). There was no association found between BMI and smoking (p-value=0.151). In a Japanese study by Watanabe, Tsujino, Konno, Ito, Takashina, Sato, Isada, Ohira, Ohtsuka, Fukutomi, and Nakamura (2018), it was reported that BMI and the prevalence of obesity of current-smokers were significantly lower than those who had never smoked. These results are consistent with previous reports in the studies done by Mackay, Gray, and Pell, (2013); Clair, Chiolero, Faeh, Cornuz, Marques-Vidal, and Paccaud (2011). Another study in Sweden reported that even though current smokers had significantly larger waist circumference and higher WHR, they had similar BMI and breast volume compared with non-smokers (Ellberg, Olsson & Jernstrom, 2018).

The study looking at the association between smoking and abdominal obesity in Austria reported that no statistically significant differences in the patterns of abdominal obesity assessed through WHR were found between three groups of smokers, non-smokers, and former smokers (Gasperin, Neuberger, Tichy, & Moshammer, 2014). In the current study, there was a statistically significant relationship between smoking and WHR (P =0.009). On the contrary, the Hitachi study shows a negative correlation of obesity with smoking (Matsushita, Nakagawa, Yamamoto, Takahashi, Noda & Mizoue, 2011). This study concluded that current smokers had less BMI or less waist circumference.

Alcohol consumption is associated with an increase in the prevalence of underweight, obesity, overweight, and premature death globally (Mekonen *et al*., 2017). This study reports that there is no statistical significance between alcohol and BMI, WHR, and body fat percentage may be because the majority of participants (43.7%) had never taken alcohol. These results conflict with those of Eastern Thailand which discovered a positive relationship between alcohol consumption and BMI in university students (Booranasuksakul, Singhato, Rueangsri & Prasertsri, 2019). That study also revealed that the average daily alcohol consumption of the overweight group was significantly higher than the underweight and normal-weight groups in women (Booranasuksakul *et al*., 2019). This concurs with a Japanese study that revealed a notable increase in the prevalence of metabolic syndrome in alcoholic drinkers (Wakayabashi, 2011).

The study conducted in Atlanta by Beardsley (2014) reported that the frequency of alcohol consumption was negatively associated with median body fat percentage in female participants (p-value=0.023) but not BMI or WHR. However, in this study, the frequency of alcohol consumption was positively associated with WHR among men (p=0.030). On the contrary, a study done in Denmark looking at alcohol consumption and its interaction with

adiposity-associated genetic variants found that there was an inverse relationship between alcohol intake and body weight and also between alcohol intake and waist circumference (Rohde, Angquist, Larsen, Tolstrup, Husemoen, Linneberg, Toft, Overvad, Halkjær, Tjonneland & Hansen, 2014). However, a study conducted in Spain discovered alcohol consumption is directly associated with waist circumference and with a higher risk of abdominal obesity in men but not in women (Schröder, Morales-Molina, Bermejo, Barral, Mándoli, Grau, Guxens, de Jaime Gil, Álvarez & Marrugat, 2007).

5.6 Demographic characteristics and overweight/obesity

Demographic characteristics are important determinants of health. In this study, participants were educators. Educators are among middle-income workers in South Africa, thus considered average income earners, which might contribute to the high prevalence of overweight and obesity. Moreover, overweight and obesity were more dominant among participants between 45-54 years and over 55 years. (Colecraft *et al*., 2018). On the other hand, you will consider educators to better understand nutrition, which might improve their eating habits.

There were more female educators in the current study than their male counterparts. These statistics could reflect the gender distribution in the South African adult population, where we have more females compared to males (WHO, 2019). The Organization for Economic Co-operation and Development (OECD) Teaching and Learning International Survey (2018) reported that 60% of South African educators are female. A similar observation was made in the study conducted in Jequié and Brazil where majority of educators were females (Rocha, Cardoso, Santos, Munaro, Vasconcelos & Petroski, 2015). Moreover, in this study overweight was more prevalent amongst female compared to males' participants (34.1% and 33.6% respectively).

5.7 Chapter summary

This chapter discussed the findings of the present study with the literature. The findings from the study were comparable with other studies conducted globally, internationally, nationally, provincially and locally.

CHAPTER 6

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter presents a summary of the study, conclusions, recommendations based on the findings of this study, which are presented and discussed in the previous chapters, and limitations.

6.2 Summary of key findings

The overarching aim of this study was to investigate the prevalence and associated health risk factors of overweight and obesity among educators in Nkomazi Local Municipality, Ehlanzeni District, Mpumalanga Province. The major findings of this study are summarized below.

6.2.1 Prevalence of overweight and obesity among educators in Nkomazi Local Municipality

There was, in general a high prevalence of overweight and obesity among educators in Nkomazi Local Municipality, Ehlanzeni District, Mpumalanga Province. The results indicated differential categories of overweight and obesity among participants. Overall, BMI results revealed that one third of participants (33,9%) were overweight whilst 30.9% were obese.

6.2.2 Lifestyle risk factors associated with overweight and obesity among educators in Nkomazi Local Municipality

Equally, the study identified lifestyle-related risk factors for overweight and obesity. The findings revealed that poor nutritional choices, lack of physical activity and family history were the major factors which were associated with high prevalence of overweight and obesity. In addition, the study further found that only 13.2% of the participants were smoking cigarettes daily whilst 27.1% drank alcohol monthly. Smoking and drinking were more prevalent among the male participants compared to females. Moreover, a majority of 74.9% consumed a maximum of three meals daily whilst 60.3% were snacking in between their meals. Also 40.3% of the participants were physically inactive as they did not engage in any mode of moderate physical activity.

6.2.3 Blood pressure and glucose level among educators in Nkomazi local Municipality

The findings found that most of the participants (96.6%) had previously undergone BP check-up and about 29.2% had been diagnosed with HBP. Moreover, amongst those diagnosed, a majority of 90.7% agreed to be on medication to manage the condition. The findings further revealed that only 18.9% of the participants had been diagnosed with diabetes and as many as 51.9% were on medication.

6.2.4 Correlation between anthropometric status and lifestyle risk factors

There was a correlation between lack of physical activity practices and BMI and WHR of participants. The findings further indicated a correlation between family history of obesity and BMI. However, there was no correlation between smoking and BMI and WHR of participants.

6.3 Conclusion

The socio-demographic data of the present study was comparable to that of other studies done in developing areas. The majority of participants were university degree holders with very few who had national diplomas and higher education certificates. Most of the participants were in the age range of 25 to 34 years.

The results concluded that one third of participants fell under the overweight category followed by the normal weight category (33.6% male and 32% females). The obese category constituted 30.9%. This was consistent with other studies that had been conducted before. The age group of 25-34 years indicated the highest number of normal weight and the highest number of overweight participants. The 55 years and above category had the highest number of obesity 3 categories, which might be because the group is for the elderly who might not be physically active or going through stages like menopause and many other factors. There were no underweight participants in the age groups of 35 years and above.

It was noted that the highest number of participants had an average waist to hip ratio followed by those with an excellent WHR whilst a considerable number of the participants were at risk. Furthermore, the study revealed that most participants with an average WHR fell under the 25 to 35 years' age group whilst the majority of "at-risk" participants fell under the 45-54 years' age group. Males were discovered to have a better WHR compared to females with 31% of the females being at risk whilst only 12.2% of males were recorded to be at risk.

A majority of the participants were non-smokers, and almost half of the participants claimed to have never taken alcohol. Almost half of those who took alcoholic beverages only had 1-2 drinks per day and it was noted that the majority of these participants had alcohol almost daily. The majority of the participants had three meals a day with most of them admitting to having snacks in between meals. The highest number of snacks consumed were potato chips whilst fruits and vegetables were also a part of the snacks consumed. Even though the number of fruits and vegetables consumed per day was not determined, the results show that very few participants consume the recommended daily amount of fruits and vegetables. Over 80% of

the participants admitted to skipping meals though at the same time they claimed to be consuming at least three meals a day. Less than half of the participants ate out twice a week because they can afford to buy these foods and maybe because some are lazy to cook as they will be tired from work. The participants ate mostly meat and beans, however, they also incorporated a lot of fast foods in their diet. According to South African Food-Based Dietary Guidelines, fish, meats, and eggs can be consumed daily. However, just about one-quarter of participants consume fish, meat, and eggs daily while others consume fish, meat, and eggs once a week. Legumes are a good source of plant protein and dietary fiber and people are encouraged to consume them regularly. In the current study, most participants consume legumes on a weekly basis and very few consume them daily. An incredible number of participants asserted to drinking water “sometimes” after eating food, whilst 33.5% agreed to drink water after every meal. Even though this is recommended, most participants did not practice it. Above half of the participants had a garden in their homes where they grow vegetables and this will help them incorporate them into their diets.

Health experts recommend engaging in physical activity to improve health and boost productivity in the workplace. Adults should do at least 150 minutes to 300 minutes a week of moderate-intensity, or 75 minutes to 150 minutes a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. In this study, majority of the participants did not partake in vigorous activity, and those who participated in vigorous activity mostly did it at least 3 to 5 times a week. Most of the participants who did vigorous activity did it for a duration of 10 to 30 minutes per exercise session. Furthermore, it was noted that those who participate in moderate-intensity activity mostly spent between 30-59 minutes per exercise session. Moreover, a worrisome 49.5% of the participants spent more than 10 hours sitting which may be due to work commitments.

Most of the participants had never been diagnosed with high blood pressure and those with high blood pressure were on medication whilst the others were managing it in natural ways. The study concluded that most males were at a higher risk of hypertension compared to females. Only a few participants were diagnosed with high blood glucose levels on blood glucose levels. The participants were managing their high blood glucose levels with medicine or through lifestyle changes. The study concluded that there were associations between smoking and body percentage, with a P-value= 0.046. Moreover, associations were observed between smoking and waist-hip ratio (P-value= 0.009). However, there was no association between alcohol consumption and sitting lifestyle risk factors with body percentage, waist-hip ratio, and BMI.

6.4. Recommendations

Based on the above conclusions, recommendations were made which are mainly informed by the primary research findings. They are arranged as follows:

6.4.1 Department of Health

In collaboration with the Department of Education, the Department of Health should develop intervention programs that would focus on health promotion for educators. This could be done by coming up with various events that will create awareness on the importance of the physical activity, promotion of nutritious food at school canteens and tuckshops and the implications of unhealthy lifestyle choices. Moreover, health authorities and regulators can come up with strategies for educating diabetic and hypertensive workers especially in rural areas. This will help improve overall health outcomes and provide awareness on long-terms complications. Collaboration efforts by clinicians and health authorities aimed at addressing risk factors in order to achieve hypertension and diabetes among teachers.

6.4.2 Schools

The schools should also have committees that deal with health promotion in the workplace where teachers participate in sporting activities. It is also recommended that health promotion facilities like gyms or sports centres are made available to educators at affordable prices to promote participation. They should provide showers and/or changing rooms for the facilities.

6.4.3 Department of Education

The employers must also allow flexible work time or breaks for participation in physical activity for the educators.

6.4.4 Teachers

The teachers should form health clubs that are health related. These clubs must encourage accountability by having target goals and schedules. For motivation, they can formulate groups with other teachers in the circuit on social media to show their progress. On these groups, they can share health and nutritional tips to encourage change of lifestyle habits and adopting healthier lifestyle. For example, teachers should be involved in a sugar-free diet for 90 days.

6.4.5 Future research

This study recommends that further longitudinal studies and intervention studies focus on those diagnosed with obesity or those at risk of diseases associated with sedentariness. In addition, a comparative study can be done with other occupations to check similarities and

differences in anthropometric measurements, nutritional knowledge and practices, lifestyle habits, and many other variables. This study recommends other researchers to conduct other surveys focusing on other circuits and other districts of the Mpumalanga Province.

6.5 Limitation of the study

The study focused on educators from Nkomazi Municipality which is a local municipality and, the findings cannot be generalized. However, transferability may be done if the context is similar.

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APPENDIX 1: INFORMATION SHEET

RESEARCH ETHICS COMMITTEE

UNIVEN Informed Consent

Appendix 1

LETTER OF INFORMATION

Title of the Research Study : Prevalence and associated health risk factors of overweight and obesity among educators in Nkomazi Municipality, Ehlanzeni district.

Principal Investigator/s/ researcher : Prudence Evelina Chambale, Master of Public Health

Co-Investigator/s/supervisor/s : Dr L.F Mushaphi and Dr J.T Mabunda

Brief Introduction and Purpose of the Study: obesity occurs when energy is being stored rather than being used. It is caused by the adoption of unhealthy lifestyle behaviors. Obesity is a major risk factor for non-communicable diseases such as CVD`s which later result in premature death. The purpose of the study is to investigate the overweight and obesity prevalence and associated health risk factors among educators in Nkomazi Municipality, Ehlanzeni district.

Outline of the Procedures : The researcher will be taking measurements using anthropometric tools (weighing scale, stadiometer, skinfold calliper and tape measure) and asking WHO stepwise questionnaire to gather lifestyle habits of participants in Nkomazi Municipality, Ehlanzeni district. The researcher will meet the participants in their respective offices and staff rooms. Participants are expected to participate voluntarily.

Risks or Discomforts to the Participant: A minor discomfort will be experienced during blood glucose measurement. The prick on the finger will be a little bit painful but the pain will fade away after some few minutes. In addition, a small sample of blood will be drawn from the finger and this blood will only be used for the research purpose which is to determine blood glucose level. Other than that, there are no known risks which may be encountered by taking part in the study except for those that we experience in our daily lives.

Benefits: The researcher will benefit from the participants so that she can complete the Master's degree. The participants may benefit when the research has been published, they will know their state of health.

Reason/s why the Participant May Be Withdrawn from the Study: There will not be any adverse consequences if the participant wishes to withdraw from the study. Participants can withdraw if they no longer wish to proceed throughout the study.

Remuneration: There will not be any monetary payment to participants for participating in this study.

Costs of the Study: Participants will not cover any of the study costs. The researcher will fund the study.

Confidentiality: Participants' names will be kept confidential, meaning that the researcher will not write participants' names on the data collection sheet when gathering data. Furthermore, the data collection sheets will be kept in a locked safe place to promote confidentiality.

Research-related Injury: There are no research-related injuries anticipated. The researcher will cease from the measurements should the participant feel they want to withdraw from the study.

Persons to Contact in the Event or Any Problems or Queries:

Please contact the researcher +2766 323 1607, my supervisors Dr L.F Mushaphi +2782 444 7326 and Dr J.T Mabunda +2782 842 6328 or the University Research Ethics Committee Secretariat on 015 962 9058. Complaints can be reported to the Director: Research and Innovation, Prof GE Ekosse on 015 962 8313 or Georges Ivo.Ekosse@univen.ac.za

General:

Potential participants must be assured that participation is voluntary and the approximate number of participants to be included should be disclosed. A copy of the information letter should be issued to participants. The information letter and consent form must be translated and provided in the primary spoken language of the research population.

APPENDIX 2: CONSENT FORM

Statement of Agreement to Participate in the Research Study:

0

- I hereby confirm that I have been informed by the researcher, Prudence Evelina Chambale about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _,
- I have also received, read and understood the above written information (*Participant Letter of Information*) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerized system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during this research which may relate to my participation will be made available to me.

Full Name of Participant Date Time Signature

I, ...
.....

(*Name of researcher*) herewith confirm that the above participant has been fully

Informed about the nature, conduct and risks of the above study.

Full Name of Researcher

..... Date..... Signature.....

Full Name of Witness (If applicable)

…… Date …… Signature……..

Full Name of Legal Guardian (If applicable)

…… Date…… Signature……

Consent for blood glucose measurement

I hereby agree to be measured for blood glucose. I am aware that blood will be drawn from my finger and I am aware of the risks involved in this measurement. I understand that my participation is voluntary and I am allowed to refuse if I am not comfortable. I am also aware that my participation will be kept confidential and that the results will be used for the purpose of the study only.

Signature of participant……

Date……

Please note the following:

Research details must be provided in a clear, simple and culturally appropriate manner and prospective participants should be helped to arrive at an informed decision by use of appropriate language (grade 10 level- use Flesch Reading Ease Scores on Microsoft Word), selecting of a non-threatening environment for interaction and the availability of peer counseling (Department of Health, 2004)

If the potential participant is unable to read/illiterate, then a right thumb print is required and an impartial witness, who is literate and knows the participant e.g. parent, sibling, friend, pastor, etc. should verify in writing, duly signed that informed verbal consent was obtained (Department of Health, 2004).

If anyone makes a mistake completing this document e.g. a wrong date or spelling mistake, a new document must be completed. The incomplete original document must be kept in the participant's file and not thrown away, and copies thereof must be issued to the participant.

APPENDIX 3: REQUEST FOR PERMISSION LETTER

Miss P.E Chambale

University of Venda

Private Bag

X 5050

Thohoyandou

27 January 2020

The Mpumalanga Department of Basic Education

Private Bag X11341

Mbombela

1200

Dear Sir/ Madam

RE: Request for permission to conduct a study among educators at schools in Nkomazi

I, Prudence Evelina Chambale a Master of public health student at the University of Venda hereby request for permission to conduct a study under the topic “Prevalence and associated health risk factors of overweight and obesity among educators at Nkomazi Municipality, Ehlanzeni District using educators as participants. The main aim of the study is to determine the prevalence and associated health risk factors among educators in Nkomazi Municipality, Ehlanzeni district. The research will help the department of education to know the number of teachers which are suffering from obesity and ways of controlling, managing and preventing obesity so that teachers can be more productive in the working environment.

Data will be collected using questionnaire (to obtain demography and lifestyle behaviour of teachers), weighing scale (to measure weight of teachers), stadiometer (to measure height of teachers, anthropometric tape (to measure waist and hip circumference of teachers), Skinfold caliper (to measure percentage body fat of teachers). The process of gathering data from teachers will take approximately a month. Data will be collected afterschool. The University of Venda Research Ethics Committee have approved the study and given me permission to collect data (see the approval letter).

Yours Faithfully

Miss Chambale P.E

APPENDIX 4: PERMISSION LETTER FROM DoE

education
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

Ikhamanga Building, Government Boulevard, Riverside Park, Mpumalanga Province
Private Bag X11341, Mbombela, 1200.
Tel: 013 766 5552/5115, Toll Free Line: 0800 203 116

Litiko le Temfundvo, Umnyango we Fundo | Departement van Onderwys | Ndzawulo ya Dyondzo

Ms. PE Chambale
University of Venda
Private Bag 5050
THOHOYANDOU
0990

RE: APPLICATION TO CONDUCT RESEARCH: PE CHAMBALE

Your application to conduct research study was received and is therefore acknowledged. The title of your study reads thus: "**Prevalence and associated health risks factors of overweight and obesity among educators in Nkomazi municipality, Ehlanzeni District of Mpumalanga Province.**" We trust that the aims and the objectives of the study may benefit the department, in particular, the learners who experience these health risk challenges. Your request is approved subject to you observing the provisions of the departmental research policy which is available in the departmental website and available on request. You are also requested to adhere to your University's research ethics as spelt out in your research ethics document.

In terms of the research policy, data or any research activity can only be conducted after school hours as per appointment with affected participants. You are also requested to share your findings with the relevant sections of the department so that we may consider implementing your findings if that will be in the best interest of the department. To this effect, your final approved research report (both soft and hard copy) should be submitted to the department as soon as you complete your research project. You may be required to prepare a presentation and present at the department's annual research dialogue.

For more information kindly liaise with the department's research unit @ 013 766 5476 or a.balovi@education.mpu.gov.za.

The department wishes you well in this important project and pledges to give you the necessary support you may need.

MR. J.R. NKOSI
ACTING HEAD: EDUCATION

29/01/2020
DATE

MPUMALANGA

APPENDIX 5: QUESTIONNAIRE

Questionnaire **Participants code**

Topic

Prevalence and associated risk factors of overweight and obesity among educators in Nkomazi Municipality, Ehlanzeni District, Mpumalanga Province

INSTRUCTIONS

- **Please answer all questions**
- **Please tick/cross or fill in the gaps**
- **Do not tear any page**
- **Do not write your personal information an any page of the questionnaire**
- **Number of questions=14**
- **Estimated time of completion=30 min**

Date of data collection (Day)…….(Month) ……..Year……

Date of birth (Day)……. (Month)…… (Year)……..

1. **Which circuit do you fall under?**

Malelane	**1**
Khulangwane	**2**
Nkomazi east	**3**

Section A: Demographic information

2. **What is your ethnicity group?**

Black	**1**
Coloured	**2**
Asian	**3**
Others, specify	**4**

3. **What is your age group?**

18-24 Yrs	**1**
25-34 Yrs	**2**

35-44 Yrs	**3**
45-54 Yrs	**4**
55 Yrs and above	**5**

4. What is your gender?

Male	**1**
Female	**2**

5. What is your marital status?

Single	**1**
Married	**2**
Widowed	**3**
Widower	**4**
Divorced	**5**
Other, specify	**6**

6. What is your highest level of education?

Higher certificate	1
Diploma	2
Degree	3
Honours degree	4
Master`s degree	5
Doctorate (PHD)	6
PGCE	7
Other, please specify	8

7. Years working in public facility:

1-4 years	1
5-9 years	2
10-14 years	3
≥ 15 years	4

8. **What is your household monthly income?**

Below R10 000	1
R10 000-R15 000	2
R15 000-R20 000	3
More than R20 000	4

9. **How many people are in your household?**

Less than 3	1
3 to 5	2
5 to 8	3
More than 8	4

Section B

Lifestyle behaviour

Answer the following questions about your daily habits. Kindly indicate your answer with a cross/ circle in the box next to your answer.

Smoking

10. **Do you currently smoke or use Smoking tobacco (cigarettes, pipes, cigars)**

Yes, daily	**1**
Yes, less than daily	**2**
No, not at all	**3**

11. **Do you currently use vapes/ electronic cigarettes?**

Yes, daily	**1**
Yes, less than daily	**2**
No, not at all	**3**

12. **Do you currently use smokeless tobacco (Snuff, chewing tobacco)**

Yes, daily	**1**
Yes, less than daily	**2**
No, not at all	**3**

13. Do you currently use hooka pipes

Yes, daily	**1**
Yes, less than daily	**2**
No, not at all	**3**

14. In the past, did you ever smoke?

Yes, years ago	**1**
Yes, months ago	**2**
Yes, days ago	**3**
No, not at all	**4**

Alcohol consumption

15. How often have you had a drink containing alcohol in the last year? Consider a "drink" a can or bottle of beer, cider or a glass of wine, a wine cooler, or one cocktail or shot of hard liquor (such as scotch, gin, vodka).

Never	1
Monthly or less	2
2-4 times a month	3
2-3 times a week	4
≥ 4 days a week	5

If your answer to question 15 is never or 1 go to question 18

16. How many drinks containing alcohol did you have on a typical day when you were drinking in the last year?

1-2 drinks	1
3-4 drinks	2
5-6 drinks	3
7-9 drinks	4
≥10 drinks	5

17. How often in the last year have you had 6 or more drinks on one occasion?

Less than monthly	**1**
Monthly	**2**
Weekly	**3**
Daily or almost daily	**4**

Nutritional practices

18. How many times do you eat per day?

Once per day	**1**
Twice per day	**2**
Three times per day	**3**
Four times per day	**4**
More than 4 times a day	**5**

19. Do you snack between the meals?

Yes	**1**
No	**2**
Sometimes	**3**

20. Snacks consumed between the meals mostly

Potato chips	**1**
Yogurt	**2**
Fruits	**3**
Vegetables	**4**
All of the above	**5**

21. Do you usually skip meals?

Yes	1
No	2
Sometimes	3

22. Why do you usually skip meal?

No appetite	1
No appetite due to illness	2
Don't feel hungry	3
Don't feel hungry due to having a big previous meal	4
No one could cook for me	5
Lack of money to purchase	6
Always busy working	7
I don't feel like eating alone	7
Others, please specify	7

23. How often do you eat out per week (restaurants, fast food or chines food)?

Daily	**1**
Once per week	**2**
Twice per week	**3**
Three times per week	**4**
Four times per week	**5**
More than four times	**6**
Not at all	**7**

24. How many times do you eat fruits per week (Bananas, apples, mangoes etc.?

Daily	**1**
Once per week	**2**
Twice per week	**3**
Three times per week	**4**
Four times per week	**5**
More than four times per week	**6**
Not at all	**7**

25. How often do you eat fish, chicken, eggs, lean meat per week?

Daily	**1**
Once per week	**2**
Twice per week	**3**

Three times per week	**4**
Four times per week	**5**
More than four times per week	**6**
Not at all	**7**

26. How often do you eat beans per week?

Daily	**1**
Once per week	**2**
Twice per week	**3**
Three times per week	**4**
Four times per week	**5**
More than four times per week	**6**
Not at all	**7**

27. How often do you eat processed food (sausage, bacon, ham, canned meat etc.) in a week?

Daily	**1**
Once per week	**2**
Twice per week	**3**
Three times per week	**4**
Four times per week	**5**
More than four times	**6**
Not at all	**7**

28. How often do you eat mass, milk and yogurt in a week?

Daily	**1**
Once per week	**2**
Twice per week	**3**
Three times per week	**4**

Four times per week	**5**
More than four times	**6**
Not at all	**7**

29. How often do you drink soft drinks, Juice & energized drinks in a week?

Daily	**1**
Once per week	**2**
Twice per week	**3**
Three times per week	**4**
Four time per week	**5**
More than four times per week	**6**
Not at all	**7**

30. Do you drink water after every meal?

Yes	**1**
No	**2**
Sometimes	**3**

31. Do you have garden for food production?

Yes	**1**
No	**2**

32. If yes to question 31, indicate the type of garden

Fruit garden	**1**
Vegetable garden	**2**
Field for ploughing maize	**3**

Physical activity

33. Do you do any vigorous-intensity activity that causes large increases in breathing or heart rate (like sprinting, jogging carrying or lifting heavy loads, digging, construction at home) for at least 10 minutes continuously?

Yes	1
No	2

If your answer to question 33 is no or 2 go to question 36

34. In a typical week, on how many days do you do vigorous intensity as part of your physical work?

1-2 days	1
3-5 days	2
More than 5 days	3

35. How much time do you spend doing vigorous-intensity activities on a typical day?

Less than 10 min	1
10-30 min	2
30-59 min	3
More than 1 hour	4

36. Do you do moderate intensity activity that causes small increases in your breathing or heart rate such as brisk walking (or carrying light load) for at least 10 min continuously?

Yes	1
No	2

If your answer is no or 2 on question 36 go to question 38

37. In a typical week, how many days do you spend doing moderate-intensity as part of your physical work?

1-2 days	1
3-5 days	2
More than 5 days	3

38. How much time do you spend doing moderate-intensity on a typical day?

Less than 10 min	1
10-30 min	2
30-59 min	3
1 hour	4

More than 1 hour	5

Sedentary behaviour

The following question is about sitting or reclining at work, at home, getting to and from work places or with friends including time spent sitting at a desk, sitting with friends, travelling in a car, bus, taxi, reading, playing cards or watching TV, but do not include time spent sleeping

39. How much time do you usually spend sitting or reclining on a typical day?

≤ 30 min	1
30 min- 3 hours	2
4-5 hours	3
5-8 hours	4
8-10 hours	5
More than 10 hours	6
Don't know	7

Section C

History of Raised Blood Pressure

40. Have you ever had your blood pressure measured by a Doctor or any other health worker?

Yes	1
No	2

41. Have you ever been told by a doctor or any other health care worker that you have raised blood pressure or hypertension?

Yes	1
No	2

If yes go to 42

42. Are you currently taking any medication for your blood pressure?

Yes	1
No	2

Section D

History of Diabetes

43. Have you ever had your blood sugar measured by a Doctor or any other health worker?

Yes	**1**
No	**2**

44. Have you ever been told by a doctor or any other health care worker that you have elevated blood sugar or diabetes?

Yes	**1**
No	**2**

If yes go to 45

45. How do you manage your diabetes?

Lifestyle modification (diet, exercise)	**1**
Medication	**2**

Section E: Family history of obesity

46. Do you have a family history of overweight and/or obesity?

Yes	**1**
No	**2**

If yes go to 47

47. Which of your relative/s suffers from overweight or obesity?

Father	**1**
Mother	**2**
Brother	**3**
Sister	**4**
Paternal grandfather	**5**
Paternal grandmother	**6**
Maternal grandfather	**7**

Maternal grandmother	**8**

Section F: Record sheet

Anthropometric measurements

Body mass, height and BMI

48	49
Weight	Height

Circumference

Girths	1st trial	2nd trial
50. Waist		
51. Hip		

Skinfolds (Males)

Site	1st trial	2nd trial
52. Chest		
53. Abdomen		
54. Thigh		

Skinfolds (Females)

Site	1st trial	2nd trial
55.Triceps		
56. Suprailiac		
57. Thigh		

Clinical measurements

Measurement	1st trial	2nd trial
58. Systolic BP		
59. Diastolic BP		
60. Glucose level		

APPENDIX 6: ETHICAL CLEARANCE

RESEARCH AND INNOVATION
OFFICE OF THE DIRECTOR

NAME OF RESEARCHER/INVESTIGATOR:
Ms PE Chambale

Student No:
11627569

PROJECT TITLE: Prevalence and associated health risks factors of overweight and obesity among educators in Nkomazi Municipality, Enhlazeni District, Mpumalanga Province.

PROJECT NO: SHS/19/PH/30/0612

SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

NAME	INSTITUTION & DEPARTMENT	ROLE
Dr LF Mushaphi	University of Venda	Supervisor
Dr JT Mabunda	University of Venda	Co - Supervisor
Ms PE Chambale	University of Venda	Investigator – Student

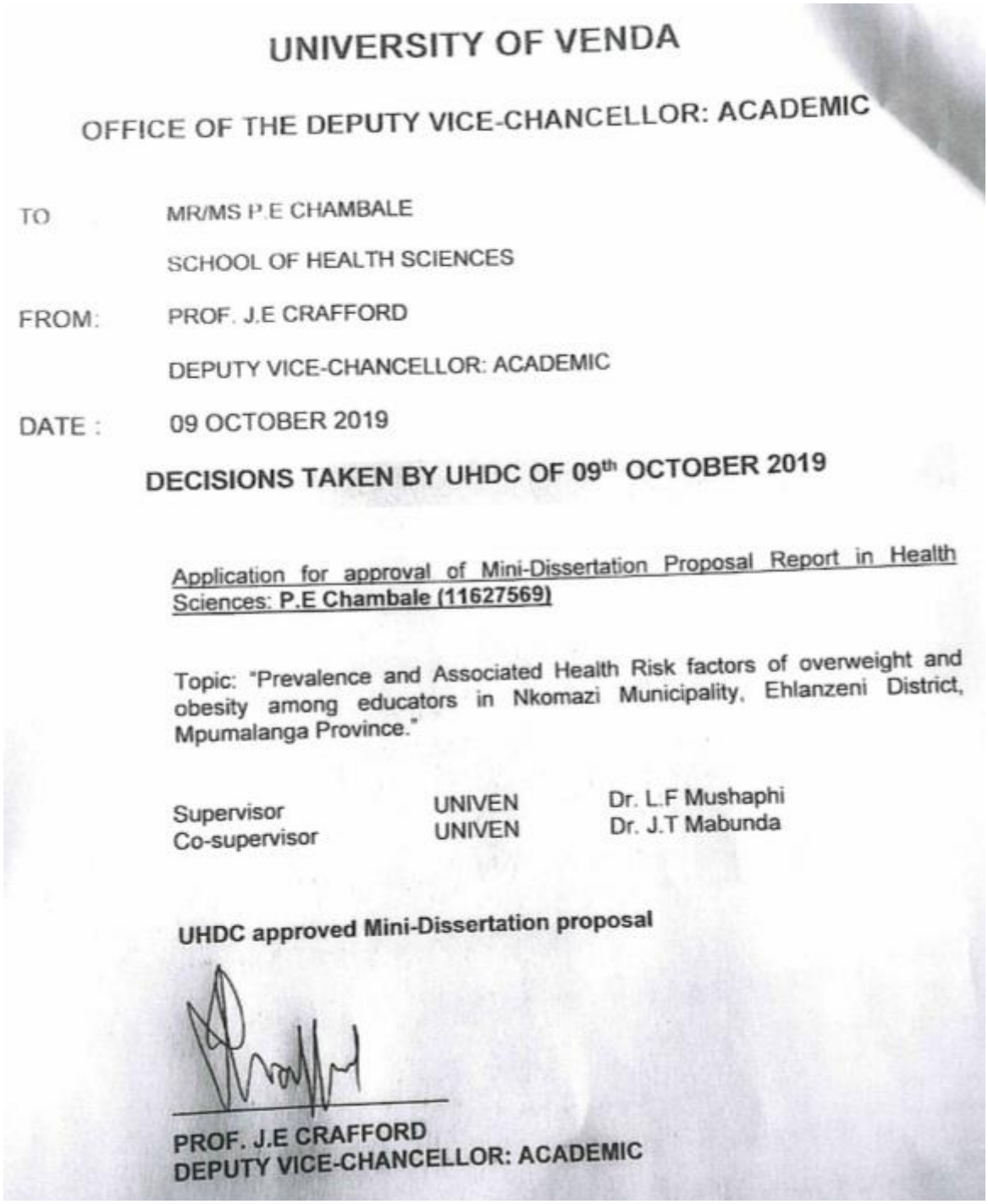
ISSUED BY:
UNIVERSITY OF VENDA, RESEARCH ETHICS COMMITTEE

Date Considered: December 2019
Decision by Ethical Clearance Committee Granted
Signature of Chairperson of the Committee: .....
Name of the Chairperson of the Committee: Senior Prof. G.E. Ekosse

University of Venda
FAX
"A quality driven financially sustainable, rural-based Comprehensive University"

UNIVERSITY OF VENDA
DIRECTOR
RESEARCH AND INNOVATION
2020 -01- 15
Private Bag X5050
Thohoyandou 0950

APPENDIX 7: UHDC APPROVAL LETTER



UNIVERSITY OF VENDA

OFFICE OF THE DEPUTY VICE-CHANCELLOR: ACADEMIC

TO MR/MS P.E CHAMBALE

SCHOOL OF HEALTH SCIENCES

FROM: PROF. J.E CRAFFORD

DEPUTY VICE-CHANCELLOR: ACADEMIC

DATE : 09 OCTOBER 2019

DECISIONS TAKEN BY UHDC OF 09th OCTOBER 2019

Application for approval of Mini-Dissertation Proposal Report in Health Sciences: **P.E Chambale (11627569)**

Topic: "Prevalence and Associated Health Risk factors of overweight and obesity among educators in Nkomazi Municipality, Ehlanzeni District, Mpumalanga Province."

Supervisor	UNIVEN	Dr. L.F Mushaphi
Co-supervisor	UNIVEN	Dr. J.T Mabunda

UHDC approved Mini-Dissertation proposal

PROF. J.E CRAFFORD
DEPUTY VICE-CHANCELLOR: ACADEMIC

APPENDIX 8: PROOF-READING LETTER

P.O BOX 663
THOLONGWE
0734
01 September 2021

Dear Sir/Madam

This is to certify that the mini-dissertation entitled “Prevalence and Associated Health Risk Factors of Overweight and Obesity Among Educators in Nkomazi Local Municipality, Ehlanzeni District, Mpumalanga Province” by Chambale Prudence Evelina (student no: 11627569) has been edited and proofread for grammar, spelling, punctuation, overall style and logical flow. The edits were carried out using the “Track changes” feature in MS Word, giving the author final control over whether to accept or reject effected changes prior to submission, provided the changes I recommended are effected to the text, the language is of an acceptable standard.

Please don’t hesitate to contact me for any enquiry.

Kind regards

Dr. Hlaviso Motlhaka (BEDSPF-UL, BA Hons-UL, MA-IUP: USA, PhD-WITS, PGDiP-SUN)

Cell number: 079-721-0620/078-196-4459
Email address: hlavisomhlanga@yahoo.com