RISK FACTORS ASSOCIATED WITH AND THE CONSEQUENCES OF OBESITY AMONG RESIDENTS OF TSHIKOTA LOCATION IN MAKHADO MUNICIPALITY, LIMPOPO PROVINCE, SOUTH AFRICA.

BY

NDOU REMBULUWANI MODDY

11606732

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SUPERVISOR: DR. T.G TSHITANGANO

CO- SUPERVISOR: DR L.F MUSHAPHI

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DECLARATION

I Ndou Rembuluwani Moddy, hereby declare that the proposal titled: "**Risk factors associated with, and the consequences of obesity among Residents of Tshikota location in Makhado Municipality, Limpopo, South Africa"** is my original work and has not been submitted for any degree at any other university or institution; and that all citations, materials and sources used herein have been duly acknowledged in a complete reference.

Ndou R.M

Student's Signature …… Date……

DEDICATION

This work is dedicated to God the Almighty who made it possible for me to pursue this degree by giving me the wisdom, strength and courage. To my parents who supported me during my studies and to Ndivhuwo my patner for his love, encouragement and support throughout this study.

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ABSTRACT

Obesity has been viewed as a serious problem that affects people of all ages, races, ethnicity, and political, religious, social and economic status. It presents a major health challenge worldwide, with an estimated 2 to 3 billion of overweight adults and 700 million of obese individuals. A cross- sectional descriptive research survey using quantitative approach was used to collect data from 318 adults aged 18-45 at Tshikota Location.. Data will be analysed using the Statistical Package for Social Sciences (SPSS) version 22.0. Cross tabulations and the Pearson's Chi-square test will be used to obtain the associations and strength of relationship between independent and dependent variables.

Results: Higher prevalence of obesity (35.5%) and overweight (28.6%) was found among the sampled population. The prevalence of obesity was found to be higher in males (51.3%) than females (46.7%), males also showed high prevalence in overweight (57.1%) than females (42.9%). There was significant different between socioeconomic status, family history and BMI. 75.2% of the participants who are obese was of those participants who do not engage in physical activity. Majority of the participants (63.5%) take meals 3 times a day and they are more likely to be obese, 19.2% of the participants do not skip breakfast. Mode of transport was positive significant to BMI as a sedentary behaviour. Neighbourhoods environment and psychological factors showed negative significant to BMI.

Conclusion: The findings of this study found the prevalence of obesity and overweight to be high among residents of Tshikota Location. Males showed higher prevalence of obesity than females, they also showed high prevalence in overweight compared to that of females. Factors contributing to obesity were found to be diverse, they include socio- demographic, lifestyle, behavioral, environment, psychological and family history.

Recommendations: The study showed a high prevalence of obesity, this study recommend an obesity awareness campaign to minimize the high prevalence of obesity in the community. The findings also showed majority of participants not having access to fruits and vegetables, improving availability of supermarkets and full service grocery stores might help the participants to have selection of healthy food such as fruits and vegetables.

Key words: obesity, overweight, factors and consequences.

LIST OF ACRONYMS

ACSM	American College of Sports Medicine
AHA	American Heart Association
BMI	Body Mass Index
BP	Blood Pressure
CVD	Cardiovascular diseases
DALY	Disability-adjusted life years
DBP	Diastolic blood pressure
G	Grams
H	Height
Kg/m^2	Kilograms per meter squared
Kg	Kilograms
NCDs	Non communicable diseases
PA	Physical activity
SA	South Africa
SSA	Sub-Saharan Africa
SADHS	South African Demographic and Health Survey
SANHANES	South African National Health and Nutrition Examination Survey
SBP	Systolic blood pressure
SES	Socio-Economic Status
USA	United States of America
WHO	World Health Organization
W	Weight

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CHAPTER 1

1.1 Introduction

This section outlines the factors that are associated with obesity and the related health challenges among residents of Tshikota Location. This chapter gives an overview of the background, where it looks at obesity from an international perspective, to Africa, South Africa and then to Vhembe District in Limpopo Province. The problem statement and the rationale for the study are also dealt with here. In addition, this chapter provides brief sections on the purpose, significance and objective of the study.

1.2 Background

Obesity is a condition in which excess body fat is accumulated over time, leading to adverse effects on health and life expectancy (Gupta, Tyagi, Mukhija, Saini, Goyal, and Shama, 2011). Individuals with an amount of body fat that increases to the point that their health starts to wear away are considered to be obese (Brodsky and Lemmens, 2011). Overweight and obesity has been used interchangeably. However, obesity only reflects excess adipose fat, while overweight reflects an excess of expected normal body weight relative to the height (Bagchi and Preuss, 2013). Body mass index (BMI), which is calculated by dividing the subject's weight by the height squared is used to measure the prevalence of obesity at population level. It is also used as a way of estimating whether an individual is overweight or obese; it is only a proxy measure of the underlying problem of excess body fat (Gupta et al., 2011). For an individual to be considered obese or overweight there are some BMI categories to be followed; for an example, an adult's BMI that is less than 18.5 is considered to be underweight and a BMI that is between 18.5–24.9 is considered to be normal weight. A BMI of 25kg/m^2 to 29.9kg/m^2 means that the person is overweight, and a BMI of 30kg/m^2–34.9kg/m^2 means that the person is class I obesity (Obese), BMI that is between 35.0kg/m^2–39.9 kg/m^2 is considered to be class II obesity (Severe obesity) and lastly BMI that is greater or equal to 40.0 is considered to be class III obesity which is described as Morbid obesity (Thompson, Gordon and Pescatello, 2010).

Obesity is increasing throughout the world and it has been a serious health issue (Muhihi, Njelekela, Mpembeni, Mwiru, Mligiliche and Mtabaji, 2012). It presents major global health challenges, with an estimated 700 million obese individuals (Ng, Fleming, Robison, Thomson et al., 2014). The phenomenon is mostly prevalent in the US, with a recent report showing that two-thirds (68.8 %) of US adults are either overweight or obese, of which 35.7% are considered to be obese and more than 5% are extremely obese (Wang, Sereika, Styn and Burke,

2013).The prevalence of obesity has increased all over the world, not only in developed nations but also in developing countries in Africa with more than 115 million people suffering from obesity-related problems (Popkin, Adair and Ng, 2012). Frempong, Agyemang, Boatemaa, Agyemang and De- Graft (2016), reported the prevalence of obesity as ranging between 3.3% and 18.0% in Sub- Saharan Africa (SSA). It is thus a leading risk factor for cardiovascular diseases (CVD) and diabetes in urban areas of Africa. In South Africa (SA) as well, obesity is emerging as a serious health hazard. The problem, however differs for men and from women. There are about 29% of men who are obese, while SA women's percentage is given as 59% (Duncan, Howe, Manukusa and Purdy, 2013).

The increasing trend of the prevalence of obesity, related morbidity and mortality has been caused by rapid urbanization, nutrition transition and reduced physical activity. These factors continue to fuel changes in living environments, diets and lifestyles in ways that promote negative energy balance (Malik, Willet and Hu, 2013). The African diet composite in nature, is compsed of whole grains or tubers, usually being the staple, accompanied with legumes, leafy and non-leafy vegetables, meat or fish and vegetable fat, their culture and diet habits encourages good healthy eating and active lifestyles (Vorster, Kruger and Margetts 2011). Several decades ago it was heresy to talk about obesity in Africa. People back then used to be physically active, because they did everything manually and depended mainly on natural food. They used to depend on farming and hunting for a living. On the other hand women used to fetch firewood in remote areas and water from rivers and grind maize traditionally. They also ate natural growing vegetables and fruits; hence this enabled them to live actively and healthy, without getting chronic conditions such as obesity.

From the 19th century obesity has been declared the epidemic burden condition, representing the leading causes of death and disability in Southern Africa (Popkin et al., 2012). Bastien, Poirior, Isabelle and Despres (2014), reported that 28 million people are dying from the consequences of obesity. The figure is more than individuals killed by pneumonia, motor vehicle accidents and airline crashes combined. It is projected that in developing countries will be accountable for almost three quarters of all deaths worldwide by 2020, with 71% of deaths resulting from cardiovascular diseases (CVD) and 70% from diabetes in developing countries (Oyeyemi, Adegoke, Oyeyemi, Deforche, Bourdeaudhuij and Sallis, 2012). Obesity gives rise to and aggravates chronic condiions such as diabetes, hypertension, cardiovascular diseases, osteoporosis and certain types of cancers that present high rates of morbidity and mortality

(Ramukumba, Wright and Hoffmann, 2013). This study aims to assess the factors that contribute to an increased prevalence of obesity and the inherent health risks.

1.3 Statement of the Problem

In year 2014 during the researcher's undergraduate internship project, the researcher observed that 61.1% of the employees at Makhado Municipality were obese, 27.8% were overweight and only 11.1% had normal BMI. Furthermore, the results on percentage body fat showed that 55.6% were obese; 38.9% were over fat and only 5.6% were healthy. The concern is that obesity is associated with high levels of chronic diseases, which leads to high levels of mortality and disability. Having observed that employees at Makhado Municipality are obese and with the knowledge that most of them are from Tshikota Location, the present researcher became interested to find out the risks factors that lead to obesity and the consequences experienced by the people of Tshikota.

1.4 Rationale of the study

Obesity has been found to be a major risk factor for the development and progression of hypertension and diabetes mellitus. These conditions have been studied frequently in urban residents. However, it has not been studied frequently in rural people (Sengwayo et al., 2012). Although some studies have been conducted on the interventions to reduce obesity inThulamela Municipality (Ramakumba, 2012) and others have studied the disease burden in other Municipalities in Limpopo, none have assessed the risk factors associated with disease in a rural community.Therefore it is of interest to help fill the gap in literature on obesity by assessing the risk factors associated with obesity and its related health risk among rural residents of Makhado Local Municipality.

1.5 The significance of the study

The results of the study contributed in providing knowledge on factors contributing to obesity and their related health consequences for the participants in the community. The results also helped in informing decisions in the review of polices by the Department of Health in the management of Obesity. The findings also formed a database for future research on obesity in Tshikota Location because there was limited literature that addresses obesity as a phenomenon.

1.6 Purpose of the study

The purpose of the was study is to describe the risk factors associated with, and the consequences of obesity among residence of Tshikota location, Makhado Municipality, Limpopo Province, South Africa.

1.7 Objectives of the study

The objectives of this study were to:

- Assess the prevalence of obesity among residence of Tshikota Location in Makhado Municipality, Limpopo Province, South Africa.
- Identify the risk factors (lifestyle, environmental, socio-economic, psychological and family history) associated with obesity among residence of Tshikota Location in Makhado Municipality, Limpopo Province, South Africa.
- Assess the consequences of obesity among residence of Tshikota Location in Makhado Municipality, Limpopo Province, South Africa.

1.8 Definitions of terms

Obesity: Obesity has been defined by WHO(20O3) as abnormal or excessive fat accumulation that may impair health. In this study obesity is defined as having a BMI which is greater than 30kg/m^2

Overweight: Overweight has been defined as weight that is higher than what is considered as a healthy weight for a given height by WHO (2003), while this study defines overweight as a BMI that is greater than 25kg/m^2

Risk factors: refers to aspects of personal behavior or lifestyle, an environmental exposure or an inherited characteristic that has been shown by epidemiological evidence to predispose an individual to the development of a specific disease (Plowman and Smith, 2011). In case of the study, risk factors are characteristics and exposure of an individual that increases chances of being obese.

LITERATURE REVIEW

2.1 Introduction

In this chapter the researcher will provide other authors' findings with regards to the prevalence of obesity globally, the factors that are associated with obesity and the inherent health risks . The factors will include lifestyle; environmental, Psychological, socio-economic and genetic factors, while inherent health risks will include high blood pressure, diabetes and high cholesterol level.

2.2 Global prevalence of obesity

The rising prevalence of obesity has trends in many countries around the world. About 2.8 million adults die each year as a result of being overweight or obese. In addition, 44% of the diabetes burden, 23% of the ischemic heart disease burden and between 7% and 41% of certain cancer burdens are attributable to excessive weight and obesity (Aliyu, Ahamad and Oyeyemi, 2014). The World Health Organization (WHO) formally recognized obesity as a global epidemic in 1997, in 2008 the World Health Organization stated that 1.5 billion adults, 20 and older, were overweight and of these over 200 million men and nearly 300 million women were obese and the figure is expected to increase to 3.28 billion in 2030 (Prinsloo, Joubert, Mohale, Nyindi, Matu, Ntechane and Struwig, 2011). According to the American Heart Association (2013), 154, 7 million of Americans adults among the age of 20 and older are overweight or obese in which 79.9 million are men and 74.8 million are women. Of these, 78.4 million are obese where in 36.8 million are men and 41.6 million are women.

Globally, between 1980 and 2008 obesity prevalence rose from 4.8% to 9.8% in men and from 7.9% to 13.8% in women (Flegal, Carroll, Kit and Ogden, 2012). According to Borrell and Samuel (2014), the Unitesd States of America has the highest obesity rates of 32% among developed countries, the rates differs with gender and ethnicity. The rates of obesity also showed an increase in England where the proportion of adults rose from 13.2% in 1993 to 26% in 2013 for men and from 16.4% to 23.8% for women. In 2015, the proportions increased from 57.6% to 67.1% in men and from 48.6% to 57.2% in women (Health and Social Care Information Centre, 2015). The rates of obesity have increased with 3 fold or more since 1980 in developing countries such as Middle East (Egypt, 25%, Iran, 10% and Saudi Arabia, 17%), Pacific Islands (Naura, 79%, Cook Islands, 43% and French Polymesia, 41%) and in German with 21%. However, the prevalence of obesity are not high in some of the developing countries

such as China (3%), India (0.5%) and Ghana (3%) (Ellulu, Abed, Rahmat, Ranneh and Ali, 2014).

Excessive weight and obesity was rarely seen in the past thousands years ago, until in the 21th century were it became common (Coil, Bibiloni, Salas, Pons and Tur, 2015). It was once considered a problem of high-income countries only but it is now also a problem in developing countries, the rates are rising worldwide (Ellulu et al, 2014,). Steyn and Mchize (2014), mentioned that obesity levels in sub- Saharan Africa are still lower than in high-income countries but certainly higher than they were two decades ago. The prevalence of overweight and obesity increased in urban areas of Cameroon between 1994 and 2003 from 54% to 82% with countries such as Burundi and Madagascar having the prevalence rates of obesity at around 40% and rates of stunting over 50% (Wamba, Oben and Cianflone, 2013)

According to Folake and Tola (2012), the prevalence of obesity has been accelerating rapidly throughout the world, not just in affluent, industrialized nations. It is also becoming common in Africa too. In many parts of Sub-Saharan Africa, there has been a marked increase in the prevalence of obesity and chronic diseases. Stevens, Sign, Lu, Danaei, Lin, Finucane, Bahalim, Mcintire, Gutierrez, Cowan, Paciorek, Farzadfar, Riley and Ezzati (2012), reported that the epidemiology of obesity in Africa varies widely between and within regions: in the West African sub-region, overweight and obesity prevalence ranged from 10% amongst Gambian males to 44% among females in Sierra Leone, with women showing more prevalence of obesity than men. The prevalence of overweight and obesity in adults population living in and around a rapidly urbanizing community in the Northern region of Ghana was found to be 33.1% and 10.3% among males, with higher figures associated with increasing age, lower socioeconomic status, smoking and drinking status as well as low physical activity (Folake et al., 2012).

The South African Demographic and Health Survey (SADHS) showed that more than 29% of men and 56% of women were classified as overweight and obese.This shows that obesity is now becoming a major disease in South Africa (Arington and Case, 2013). The 2003 SA Demographic and Health Survey and the 2012 SA National Health and Nutrition Examination Survey show that in less than a decade, obesity prevalence has increased from 8.8% to 10.6% in men and from 27.4% to 39.2% in women (SANHANES, 2013). The 2013 Global Burden of Disease Study reports that the prevalence of obesity increased to 13.5% and 42.0% for men and women respectively in 2013, with South Africa showing higher figures than those reported in other African countries (SANHANES). In a community-based study conducted among low

income elderly people in South Africa revealed widespread household food insecurity, micronutrient deficiencies, while at the same time 83.6% of the women were overweight or obese, and 68% were hypertensive (Skaal and Pengpid, 2011).

2.3 Factors associated with obesity

Obesity is a complex disease that is caused by many factors. This section will outline some factors that contribute to obesity, such as lifestyle, environmental, psychological, socioeconomic and genetics factors.

2.3.1 Physical inactivity

Skaal (2011), stated that despite the documented benefits of physical activity worldwide, more than half of adults are not regularly physically active at the recommended levels and about 60% of the global population fail to achieve the minimum recommendation of 30 minutes of moderate intensity physical activity daily; including some of those who are already physically active. South Africa appears to be a relatively inactive nation (Micklesfield, Pedro, Kahn, Kinsman, Pettifor, Tollmanand Norris, 2014). An estimated 46% of South Africans do not meet the required 150 min of moderate exercise. This applies to 48% of males and 63% of females (Department of Health, 2004). Consequently physical inactivity accounts for 3.3% of the deaths per year and 1.1% of the disability-adjusted life years (DALYs) in South Africa. (Watson, Khan and Crear, 2013).

Physical inactivity is rising in many countries, with major implications for the prevalence of non-communicable diseases (NCDs) and the general health worldwide (WHO, 2010). In addition, inadequate physical activity can itself be an independent health risk factor. A level of practice of 150 minutes/week (60 minutes per day for 5 days) of moderate exercise has been recommended for the general population (ACSM, 2013). Exercise must be structured, planned and designed to improve fitness, and sustained physical activity helps protect against weight increase, overweight and obesity, as well as enhancing fitness (Kunene and Taukobong, 2015).There is clear evidence that physical activity plays a major role in the prevention and management of various NCDs such as obesity, heart disease, diabetes mellitus, hypertension and some cancers. Furthermore, regular physical activity is an essential tool in maintaining a healthy body weight; it is associated with decreased mortality and morbidity of chronic diseases (Scholes and Mindell, 2013).

2.3.2 Dietary intake

Dietary habits and behaviours are associated with the adoption of a more Western lifestyle and represent nutrition transition in developing countries. When compared to other Sub-Saharan African countries, South Africa is considered to be 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 and Goedecke, 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.Traditional cooking and homemade foods have been replaced by high-fat, energy-dense fast foods and soft drinks. People choose energy-dense, nutrient-poor fast foods because they are cheap, tasty, widely promoted and readily available. Energy-dense foods tend to be high in fat (such as butter, oil and fried foods), sugar or starch, while energy-dilute foods have high water content (such as fruits and vegetables) (Ha, Chung, Lee, Kim, Joung, Paik and 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.There is 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 result in a positive balance of total energy intake (Folake et al., 2012).

Eating habits also have a bearing on the development of obesity. Skipping breakfast may lead to over-consumption later in the day. Besides, those who eat out more, on average, have a higher BMI than those who eat at home more often overeating, eating the wrong foods and not eating breakfast have been reported as the other causes of overweight and obesity (Al-Rethaiaa, Fahmy and Al-Shwaiyat, 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 sugary foods in excessive amounts is bad for them, and that exercise is good for them. However, they tend to enjoy eating these foods and find it difficult to exercise (Van den Berg, Okeyo, Dannhauser and Nel, 2012). Lupi, Bagordo, Stefanati, Grassi, Piccini, Begamini and De- Donno (2015), in their study among undergraduate students reported that students who take fatty foods also spend most of their time in sports activities .

2.3.3 Sedentary behaviour

Sedentary behaviour describes the behaviours of sitting or lying down while awake. This includes sitting while watching TV; driving a car, working at a desk, doing schoolwork sitting and using a computer or mobile device (Tremblay,Colley,Saunders, Healy and Owen,2010). Sitting and physical inactivity for prolonged periods each day, no matter what else people do, impairs their health.Too much sitting is associated with higher mortality rates and with developing diabetes and other chronic diseases (Department of Health, 2010). Modern living has facilitated a more sedentary lifestyle for many populations. Man was created to be active and energetic; however, sedentary lifestyle contrays. Even our grand-parents used to be active, engaging in vigorous muscular activities such as hunting, grinding and farming as a fact of life. They also lived longer and healthier. Deaths were reviewed in the 20th and 21st century as a result of diseases associated with individuals lifestyles (Mfrekemfon and Stella, 2015).

Contributing factors have included the increase in labour-saving devices at work, home, transit and play, while leisure time activities increasingly involve passive entertainment. Now most people do not rely on physical activity at work and they also have a relatively sedentary lifestyle outside work (Al-Nakeeb, Lyons, Collins, Al-Nuaim, Al-Hazzaa, Duncan and Nevill, 2012). Technology has been utilized to make life easier through devices such as remote controls, microwaves, garage door openers, electric lawn mowers and washing machines. This has decreased the total amount of personal resources involved in physical activity. Social networking and surfing the Internet cannot help either (Marshall et al., 2011). Although it is not possible to show a direct relationship between obesity and any single technology, technological advancements such as television, cars and computers have engineered much of physical effort out of our lives. It is certainly true that physical activity has declined significantly, with people walking and cycling less and driving more even for short journeys (Malik et al., 2013). Giles-Corti, Macintyre, Clarkson, Pikora and Donovan (2003), reported lifestyle factors to be more contributing in obesity. The odds of being overweight were reported to be doubling among respondents who watched television 3 or more hours a day compared to those who do not watch television.

2.3.4 Environmental factors

Environmental factors can play a role in determining energy intake and physical activity. The modern society can be classed as an “obesogenic environment”, which is a condition due to the effects of the surrounding towns and city people live in. Opportunities on how food can be easily accessed have an input on promoting obesity in individuals and populations (Giles-Cort et. al., 2003).Our homes, neighborhoods, schools and communities can all become environments that encourage obesity. The term has been coined to describe an environment where physical activity is discouraged and unhealthy food consumption is encouraged. The term relates to the social, cultural and infrastructural (such astransportation) conditions that influence our ability to adopt to unhealthy lifestyles. (Garduno-Diaz and Garduno-Diaz, 2014).

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 (Oyeyemi et al., 2012). 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. In most cases, cheaper food sources tend to be more energy-dense and nutrient-poor. They provide plenty of calories in the form of fats and sugars, but relatively low levels of vitamins, minerals and fibre (Rattray, Kroch, Ritterman-Weintraub, Rovira-Ostterwalder and Mitosevich, 2013). There are changes in food purchases, prices for fruits and vegetables have increased, while prices for fats, oils and sugars have decreased. The environment must have access to playgrounds; with pedestrian pathways and sports facilities also being key considerations. Lack of pedestrian amenities, difficult to access destinations and poorly-connected street patterns contribute to reduced physical activity and development of obesity (Oyeyemi et al., 2012).

2.3.5 Psychological factors

2.3.5.1 Stress

The physiological regulator of the adaptive response to stressors, may become deregulated over time with excessive or repeated stimulation, resulting in the deregulation of glucocorticoids, in particular (Wang, 2005). Glucocorticoids are hormones that plays an important role in appetite regulation. In a stressful situation following hours and days, the release ofglucocorticoids results in the stimulation of feeding (Ali and Crowther, 2009). If the stressor becomes chronic, glucocorticoids can become chronically elevated, leading to chronically

stimulated appetite, increased feeding and consequent obesity (Wang, 2012). Glucocorticoids also play a role in the regulation of lipid metabolism and homeostasis. Excessive glucocorticoids are associated with increased visceral fat deposition; a phenotype associated with increased risk of cardiovascular disease (Wolf, 2008).

Chronic stress, and the result of increased glucocorticoids, can both predispose an individual to obesity, or worsen an existing obese phenotype. There is compelling evidence that the intrauterine and neonatal environment may contribute to obesity in adults. In addition, psychosocial stress at critical periods of development may be one of these factors (Derman, Whitesman, Dreyer,Patel,Nossel,Lambert and Schwellnus, 2011).

2.3.5.2 Disorder eating

The most common eating disorders are anorexia nervosa, bulimia nervosa and binge eating, with binge eating disorder being the one which causes weight gain. Binge eating disorder means eating large amounts of food in a short period of time, usually alone, without being able to stop when full (Bardone-Cone, Wonderlich, Frost, Bulik, Mitchelll, Uppala and Simonich, 2007). Overeating and bingeing are often accompanied by feeling out of control followed by feelings of depression, guilt, or disgust (Sominsky and Spencer, 2014). Binge eating that is not followed by purging may also be considered an eating disorder and can lead to weight gain. More than one-third of obese individuals in weight-loss treatment programmes report difficulties with binge eating. Eating problems contribute to feelings of shame, loneliness, poor self-esteem, and depression. A person may binge or overeat for emotional reasons, including stress, depression, and anxiety (Annagur, 2011). Hairies and Neumark-Sztainer (2006), 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.

2.3.6 Socio-economic factors.

Socio-economic status is another important factor that influences dietary quality and food choices. Socio-economic status(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 Mlcklesfield 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.

Gutterman (2011), stated that obesity prevalence decreases as household income increases and as the education of the head of household increases, 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. Household food security may be described as a continuum, from food security, food insufficiency where there are some concerns regarding having enough funds to buy food for the month, without changing the diet. Low food security typically reduces the quality of the diet, while in food insecure there is a reduced food intake and skipping of meals (Mlckesfield et al., 2013).

Obesity has been found to be more prevalent in the poor population. 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. The less the money you have, the less inclined you feel to spend it on wholesome food. A millionaire may enjoy breakfasting off orange juice and biscuits, while an unemployed man does not. Well planned nutritious meals are more difficult to have and maintain when finances are tight (Jeffords, 2010). Shayo and Mugusi (2011), in their study reported the prevalence of obesity to be highest among those with high socio-economic status, compared to those with medium status and low socio-economic status.

Over the past 30 years obesity has been steadily increasing, even in low and middle-income countries, including those in Sub-Saharan Africa. From around 1975 to date, urbanization has been increasing steadily in Sub-Saharan Africa. In addition, urbanization has been accompanied by a massive growth of industry, especially that of food manufacturing in urban areas of Africa (Scott, Ejtkeme, Clottey and Thomas, 2012). This has resulted in the emergence and popularization of soft drinks and fast foods and many Western brand names on the

continent. In many urban areas, such Western food items were regarded as desirable status symbols, rapidly inculcated by local inhabitants, and widely consumed. These products are disproportionately expensive in relation to average incomes and frequently of undesirable nutritional value (Steyn et al., 2014).

2.3.7 Genetic factors

There is a significant link between obesity and genetics. Genetics is the field of science that looks at how genes are passed down from one generation to another to influence traits. If one's parent is obese, the risk of developing obesity significantly increases (Puiu, Emandi and Arghirescu, 2013). The strongest risk factor for childhood and adolescent obesity is parental obesity. The risk becomes especially elevated if both parents are obese.Having two obese parents makes a child six times more likely to become obese himself, having only one obese parent still makes a child twice as likely as children of non-obese parents to be obese (Hasselbalch, 2010).

Puiu et. al, (2013), emphasized that obesity inheritance does not only follow classic Mendelian patterns but also a combination of gene mutations, deletions and single nucleotide polymorphisms are all known to contribute to obesity. Most cases are polygenic, which results from multiple genes interacting with a shifting environment with each obesity gene only making a small contribution to the phenotype, but in all inherited genetic variations play a major role in determining the body mass and how the body maintains a balance between physical activity and nutrition (Rao,Lai and Giridharan, 2014). While obesity is most commonly associated with polygenic inheritance, there are other instances in which the cause is monogenic or syndromic. Monogenic obesity typically is caused by a single gene mutation with severe obesity as the main symptom. Syndromic obesity, on the other hand, has many characteristics, of which obesity is one symptom (Choquet and Meyer, 2011).

2.4 Health consequences associated with Obesity

Sengwayo, Moraba and Motaung (2012), reported that the prevalence of excessive weight and obesity is increasing, with obesity being estimated to be the second leading cause of mortality and morbidity, causing about 2.6 million deaths worldwide and 35.8 million of global disability adjusted life years (DALYs).

Obesity is a prevalent health hazard, both in developed and developing countries, and is associated with a number of pathological disorders, including hypertension, type 2 diabetes mellitus, cardiovascular disease (CVD), high cholesterol levels, cancerandarthritis(Shukla, Kumar and Singh, 2014). The degree of health impairment caused by obesity is determined by the amount of fat and the distribution of fat. The fat deposition may occur in different adipose tissue compartments (Lokuruka, 2013). Two major variants of obesity are distinguished for their differential impact on morbidity. Android type of obesity is likened to the shape of an apple. The shoulders, face, arms, neck, chest and upper portion of the abdomen are bloated. This type of obesity is associated with a major risk for heart damage and heart disease due to high cholesterol (Despres, 2011). Accumulation of fat in the gluteofemoral area is the main feature of gynoid obesity, which is more frequently found in premenopausal women and apparently is not associated with increased risk of CVD (Patidar, 2013). In this study the researcher will focus on hypertension, type 2 diabetes and hyperlipidemia as the related health risks caused by obesity.

2.4.1 Obesity and Hypertension

Obesity and weight gain 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 7mmHg rise in systolic blood pressure (SBP) (Kotchen, 2010). The National Health and Nutrition Examination survey reported linear association between an increase in Body Mass Index and systolic, diastolic and pulse pressure in the American population. It has been reported that an increase of BMI of 1.75 kg/m^2 in men and 1.25 kg/m^2 in women will cause 1 mm Hg rise in systolic blood pressure. As a result obese patients are more prone to hypertension and hypertensive patients also appear prone to weight gain (Amira, Sokunbi and Sokunbi, 2012).

A strong relationship has been shown to exist between body weight and blood pressure, with the risk of developing hypertension being two to six times higher in excessive weight individuals than in normal weight individuals (Vaneckova, Maletinska, Behuliak, Nagelova, Zicha and Kunes, 2014).Excessice weight and obesity are associated independently with an increased risk for heart failure, while weight loss leads to decreased blood pressure. This is because weight loss is associated with reductions in vascular resistance, total blood volume and cardiac output, improvement in insulin resistance, reduction in sympathetic nervous system activity, and suppression of the activity of the renin-angiotensin-aldosterone system (Oni, Odia and Iruegbukpe, 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. Markers of general obesity and indicators of abdominal obesity are good predictors of cardiovascular risk (Lategan, Van den Berg and Walsh, 2014).

2.4.2 Obesity and Diabetes

Diabetes is a metabolic condition in which the body does not produce sufficient insulin to regulate blood glucose levels or where the insulin produced is unable to work effectively. There are two main types of diabetes; namely type 1 and type 2 diabetes.Type 1 diabetes is an auto-immune condition in which the cells that produce insulin are destroyed and lifelong treatment with insulin is required to prevent death. About 10% of people with diagnosed diabetes have type 1 diabetes. (Gatineau, Hancock, Holman , Outhwaite, Oldridge, Christie and Ells, 2014).
Type 2 diabetes accounts for at least 90% of all cases of diabetes. It occurs when the body either stops producing enough insulin for its needs or becomes resistant to the effect of insulin produced (Hussan, Hydrie, Claussen and Asghar, 2010).

Gatineau et al. (2014), further mentioned that obesity is only associated with type 2 diabetes. There is a close association between obesity and type 2 diabetes. The likelihood and severity of type 2 diabetes are closely linked with body mass index (BMI) (Yaturu, 2011). There is a seven times greater risk of diabetes in obese people compared to those of healthy weight, with a three fold 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 (Foulds, Bredin and Warburton, 2012). Obesity increases insulin resistance and glucose in tolerance Via these metabolic effects, obesity plays a major role in the pathophysiology of type 2 diabetes (De Paula and Rosen, 2010). Insulin resistance may present

10 - 20 years before the onset of the disease, and is considered to be the best predictor of whether or not an individual will later become diabetic. It is also uncertain why not all people who are obese develop type 2 diabetes and why not all people with type 2 diabetes are obese (De Paula et al.,2010).

2.4.3 Obesity and High cholesterol levels

Hyperlipidemia is a condition in which individuals have an excess of fatty substances called lipids, largely cholesterol and triglycerides, in the blood. High lipid levels can speed up a process called atherosclerosis, or hardening of the arteries. Arteries are normally smooth and unobstructed on the inside, but as age goes, a sticky substance called plaque forms in the walls of the arteries (Hessan, 2013). Plaque is made of lipids and other materials circulating in your blood. As more plaque builds up, arteries can narrow and stiffen. Hyperlipidemia has been implicated in atherosclerosis, which is the primary cause of heart disease and stroke (Harikumar, Althaf, kumar, Ramunaik and Suvarna, 2013). It is well known that obesity is positively associated with an increased risk for atherosclerotic disease. Klop, Elte and Cabezas (2013) emphasized that cardiovascular risk factors such as increased fasting plasma triglycerides, high LDL cholesterol, low HDL cholesterol, elevated blood glucose and insulin levels and high blood pressure occur as a result of the increase in obesity.

METHODOLOGY

3.1 Introduction

The methodology section of a research study addresses the following components: the research design, population, sampling, data collection, data analysis and ethical considerations.

3.2 Research design

A cross- sectional descriptive survey using quantitative approach was used in this study. A cross- sectional descriptive survey is a descriptive study in which disease and exposure statuses are measured simultaneously in a given population (Vogt, Gardener and Haeffele, 2012). The researcher will use a cross- sectional design as the data from the study will be collected at a point in time.

3.3 Study setting

The study was conducted at Tshikota Location, Louis Trichardt (Makhado Local Municipality) in Vhembe District, Limpopo Province, South Africa. Tshikota Location is situated about 3 kilometers from Louis Trichardt. Tshikota is a developed community consisting of permanent residences and those who come for employment at Makhado local area.Three quarters of adults use transport everyday to and from town. Tshikota is a street community, where in there are no farms and people use electricity as a source of energy and they also have water taps in their houses.

3.4 Population

The study was conducted among residents of Tshikota aged 18-45 years . The population of Tshikota Location is of 135 000 people and 1560 households.

3.5 .1 Sample size

The size of the sample was calculated using Slovin's formula and systematic random sampling technique. Slovin's formula which is $n = N \div (1+Ne^2)$, will be used to sample the households where-in: n = sample size of the adjusted population.

N= population size

e = accepted level of error which is set at 0.05

$$n = \frac{N}{1 + Ne^2}$$

$$n = \frac{1560}{1 + (1560x\ (0.05)^2}$$

$$= 1560 \div (1 + 3.9)$$

$$= 318.37 \quad \frac{1560 \div 4.9}{\text{sample size (n= 318)}}$$

318 participants were chosen from 1560 households.

3.5.2 Sampling technique

To sample 318 houses from 1560 houses, the researcher first divided 1560 by 318 to determine the sampling interval.This implies that data was collected from every 5th house. The first house was selected randomly. Only 1 participant was selected randomly from each sampled house. If the selected house has no one who meets the criteria, the researcher randomly use the following house to replace the house which had no person meeting the criteria.

3.6 Data collection tools

Data collection is a systematic way of gathering information relevant to the research purpose or question. For the purpose of this study, a structured interview questionnaire was used to obtain the following information: sociodemographic data including age, gender, educational level , occupation and contributing factors to obesity, which include lifestyle, environmental, psychological and family history. The questionnaire was developed in English and translated to Tshivenda language, as most of Tshikota residents are Venda's. Translation of languages was done by a Communication professional from the Media Studies Department at the University of Venda. It was sent to another Communication professional to translate back to English to check whether the Tshivenda version and English version have the same meaning. Anthropometric measurements; namely, weight and height were measured using a digital weighing scale and

stadiometer. Blood pressure was measured using an automatic sphygmomanometer and biochemical measurements will be measured with an Accu-check cardio machine.

3.7 Validity

Validity refers to the degree to which an instrument measures what it is supposed to measure. Acoording to Weiner (2007), validity refers to the extent to which empirical measures adequately reflect the real meaning of the concept under consideration. The supervisor was consulted for comment and opinion; whether the instrument (questionnaire) measured the factors associated with obesity. The questionnaire were restricted, based on the feedback from the supervisor. The questionnaire was then pre- tested in a population with characteristics similar to those of the study population, to determine its length, question flow, duration and clarity. Corrections were made accordingly.

3.8 Reliability

Reliability is defined as the extent to which results are consistently accurate over time. A test-retest approach was used to test the reliability of instrument both the questionnaire and equipment. Equipment were calibrated prior to the measurements to determine the validity of the instruments. Anthropometric measurements were taken twice to ensure reliability.

3.9 Data collection process

The researcher collected data from every sampled house with the help of an assistant researcher who was a Biokineticist. She received training on how to interview participants and how to take measurements, including weight, height, blood pressure, glucose and cholesterol.The assistant researcher administered the interviews and take measurements from the sampled households, while the researcher administered interviews and take measurements from the other sampled households. After collecting data from the 10 households , the researcher and her assistant met to discuss the flo9p8oiw of the questionnaire as well as the accuracy of the measurements. When participants were met in their houses, they were informed about the details of the study. After the explanation, the participants were asked to sign the consent form. When the formal agreement to participate in the study has been obtained, participants were interviewed on factors contributing to obesity followed by the measurements.

Anthropometric measurements

Weight Measurements : a digital electronical scale was used to measure weight. Prior to weighing any participant the scale was placed on a flat surface, adjusted to zero and kg. For quality control procedure, a 10 kg dummbell was weighed once before weighing any participant to ensure accuracy of the weighing scale.

Participants were requested to remove shoes and any heavy clothes such as Jackets before stepping on the scale. They were then be asked to step on the centre of the horizontal platform and look straight ahead, standing relaxed but still, until the weight is displayed. The first reading was recorded, then the participant was requested to step down. The same procedure was repeated to take the second reading, then it was recorded. Body weight was recorded to the nearest 0.1Kg (Lee and Nieman, 2010)

Height Measurements: Height was measured to the nearest 0.1 m using a stadiometer. Participants were asked to stand upright on a flat surface without shoes, with the back of the heels and the occiput touching the wall. Participants were to inhale deeply, hold their breath, and maintain an erect position (posture). The head was positioned in such a way that the angle of the eye and the operating external auditory meatus are in a horizontal line. The researcher lowered the horizontal bar until it touches the crown of the head. The height measurement were taken at maximum inspiration. The participant was asked to step down and stand again for the second reading. The body mass index was calculated as weight (kg) divided by the square of height (m^2) of each participant.

Blood pressure measurements

An automatic sphygmomanometer was used to take the measurements of Systolic blood pressure 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. They were told to refrain from smoking cigarette or ingesting caffeine 30 minutes before the measurements in order 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 participant was asked to remain still while the cuff is inflating until the testing stops and the cuff deflates and the monitor displays the results. The results were recorded and the same

procedure was repeated to have the second results. The participant's blood pressure was classified according to the protocol, as suggested by ACSM guidelines (2010).

Blood glucose and cholesterol measurements

Blood glucose and cholesterol were measured to the nearest 0.1 mmol/L using a Cardio accu-check machine. The researcher firstly ran the control test to ensure if both the meter and the test stripes were working properly and giving reliable results by inserting a new memory chip on the Cardio accu-check device to correspond to the test strips. After running the control test the machine was placed on a flat surface (such as table). Participant were asked to sit in a chair with the back supported, feet on the floor. With gloves on, left ring fingertip was cleaned with an alcohol swap and allowed it to dry, to decrease hemolysis but not alter the results. The finger was pricked with a lancet, the first drop to come out was be wiped away, then approximately 4 drops of blood was collected using a capillary tube to be inserted into the test stripe. An adhesive bandage was placed on the small puncture to stop the blood.The test stripe was then be inserted into the accu-check machine. The machine was then display the glucose results, first in less than 5 minutes, followed by cholesterol results on the digital screen. All alcohol swap covers, stripes covers and uncontaminated swaps were thrown into a black dust bin. Lancets, blood stripes and capillary tubes were thrown in a biohazard bag. All those materials contaminated with blood or fluid were thrown into a red plastic dust bin. The waste was taken to health and safety waste management (Ferguson, 2005; Skinner, 2007).

3.10 Data analysis

Data was analysed using the Statistical Package for Social Sciences (SPSS) version 23.0. Descriptive statistics (perentages) and Cross tabulations and the Pearson's Chi-square test was used to obtain the associations and strength of relationship between independent and dependent variables.The statistical significance was set at $p < 0.05$. The data was presented in the form of frequency tables to summarize the findings. BMI was subdivided into six categories which are as follows: underweight (BMI≤ 18.5), normal (18.5- 24.9), overweight (25-25.9), obese class I (30-35.9), obese class II (35-39.9), and obese class III (> 40) (ACSM, 2014). Blood pressure levels were classified as follows: normal blood pressure (≤120/≤80), prehypertension (120-139/80-89), stage 1 hypertension (140-159/90-99) and stage 2 hypertension (≥160/≥100) (ACSM and Pescatello. Glucose levels in mmol/l were catergories as follows: normal (<3.9-5.5), high risk (5.6-7.0) and very high risk (≥7.0) (Muluvhu et al., 2014) Cholesterol levels in mmol/l

were classified as : normal (<5.2), borderline (5.2-6.2) and high risk (≥ 6.2) (Muluvhu et al., 2014).

3.11 Ethical considerations

3.11.1 Permission to conduct the study

The proposal was presented to the Department of Public Health and the Higher Degrees Committee (SHDC) of the School of Health Sciences for corrections. It was be then presented to the University Higher Degrees Committee (UHDC) at the University of Venda for recommendation and approval by the University Research Ethics Committee. The ethical clearance was presented to the Councilor of Tshikota Location for permission to access the participants.

3.11.2 Informed consent

A consents form was be given to each participant to sign. The researcher ensure that all the essential information, such as purpose of the study and significance of the study, as well as voluntary participation is provided on the consent form, to enable participants to make an informed decision before signing the form. Participants were told that they have the full right to refuse participating in the research and participants that do not wish to further participate in the study can withdraw at any time.

3.11.3 Confidentiality and anonymity

The participants were told that the information collected for the research project will be kept confidential, as completed questionnaires and measurements will be kept under lock. In addition, information provided by the participants was not made available or divulged to any other person. The researcher ensure that participants remain anonymous, names or any other identifications were not recorded anywhere.

3.12 Dissemination of study findings

The report of the study in the form of a dissertation will be submitted to the Library of the University of Venda. The findings will be presented to the Health Department of Makhado Municipality. The findings will also be presented at the Provincial Research Day, workshops, national and international conferences.

CHAPTER 4

INTERPRETATION OF RESULTS

4.1 Introduction

This chapter analyses and interprets factors (socio-demographic factors, lifestyle factors, sedentary lifestyle, environmental factors, psychological factors and family history factors) and the health consequences (blood pressure, glucose and cholesterol) of obesity and determines the association between these factors variables and BMI of the participants involved in this study. Participants were interviewed and assessed as per study protocol and data was analyzed in line with the objective of the study.

4.2.1 Socio-demographic information of the participants

A total of 318 residents participated in the study of which 52.5% were males and 47.5% were females and majority of the participants (27.4 %) were between the ages of 18-24 27.4% followed by participants of age 25-35 with 25.8%. Almost half of the participates (52.2%) were single and 46.1% were married. 48.1% are at or end school at secondary level with majority of them (60.1%) being employed and most of them earning less than R1000 followed by those earning R2000 to R5000 **(Table 4.1)**.

Table 4.1 Socio-demographic information of the participants (N=318).

Characteristics	Male		Female		Total (male + female)	
	N	(%)	N	(%)	N	(%)
Gender	167	52.5	151	47.5	318	100
Age						
18-24	40	24	47	31.1	87	27.4
25-34	52	31.1	30	19.9	82	25.8
35-44	22	13.2	42	27.8	64	20.1
45-54	39	23.4	20	13.2	59	18.6
55+	14	8.4	12	7.9	26	8.2
Marital status						
Single	87	52.1	79	52.3	166	52.2
Married	78	46.7	69	45.7	147	46.1
Divorced	0	0	2	1.3	2	0.9
Widow(er)	2	1.2	1	0.7	3	0.9
Educational status						
Tertiary	24	14.4	29	19.2	53	16.7
Secondary	85	50.9	68	45	153	48.1
Primary	36	21.6	39	25.8	75	23.6
None	22	13.2	15	9.9	37	11.6
Employment status						
Employed	111	66.5	80	53	191	60.1
Unemployed	56	33.5	71	47	127	39.9
Income						
<R 1000	54	32.3	68	45	122	38.4
R2 000-R5 000	45	26.9	49	32.5	94	29.6
R5 000-R10 000	32	19.2	9	6	41	12.9
>R10 000	36	21.6	25	16.6	61	19.2

4.2.1.1 Association between Socio-demographic variables and BMI categories among residents of Tshikota location.

Obesity was found in 35.6% of the participants with 20.8% being in class 1 obesity, 14.2% being in class 2 obesity and 0.6% being extremely obese. Overweight was present in 28.6% of the participants while 32.1% of the participants were having normal weight and 3.8% of the participants were underweight. Male shows to have high prevalence of obesity in Class 1 (53%) and Class 2 (51.1) obesity while the 2 participants who were extremely obese were from males. In marriage status, single participants were mostly found with normal weight with 67.6%. Married participants showed high percentage of overweight (58.2%) and in Class 2 obesity (60%) while in Class 1 and Class 3 obesity they showed equal percentage of 50% with single participants.

Age distribution of the participants was between the range of 18-55+. Participants of age group 18-24 has most participants who were underweight (66.7%), who have normal weight (41.2%) and those with Class 1 obesity (31.8%). Most of overweight participants were found in age group 45-54 (25.3%) and lastly in age group 35-44 (24.2%). Age group 45-54 has the highest percentage of participants with Class 2 obesity (33.3) and extremely obesity (50%) together with age group 35-44 with 31.1% of participants with Class 2 obesity and 50% of those who are Class 3 obese.

From the 12 participants who were underweight Educational status consisted 10 (83.3%) participants who have Secondary status and 2 (33.3%) who were having Tertiary status. In 102 participants with normal weight (23.5%) were having Tertiary level, 50% were having Secondary status, 18.6% were having Primary status and 7.8% were those with none educational status. In all participants with overweight, 44% were from participants with Secondary status, 26.4% were from those with Primary status and 17.6% was of those with Tertiary status, the rest (12.1%) were from those with none education. Percentage of obesity was found to be less in participants with Tertiary status (6.1% in Class 1 obesity, 15.6% in Class 2 obesity and 0% in extremely Obese) compared to participants with Secondary (57.6%,28.9% and 50%) , Primary (22.7%, 35.6% and 50%)and none (13.6% , 20% and 0%) educational status.

In participants with underweight and normal weight both employed and unemployed participants were having equal percentage of 50%. In overweight participants, employed participants were 58 (63.7%) and unemployed were33 (36.3%). Employed participants have shown 53% of participants with Class 1 obesity, 86.7% of those with Class 2 obesity and 100% of those with

extremely obesity while Unemployed participants have shown 47% of participants with Class 1 obesity and 13.3% of those participants with Class 2 obesity.

In underweight participants 50% were those participants who earn less R1000 per month and the other 50% was of those who earn between R2000- R5000 per month. Of those with normal weight 46.1% was of participants who earn less than R1000 per month, 27.5% was of participants who earn R2000-R5000 per month, 7.8% was of those who earn R5000-R10000 per month and 18.6% was for participants who earn R10000 per month. Overweight participants were mostly found in participants earning less than R1000 per month (46.1%) and those participants earning R2000-R5000 per month. In participants with Class 1 obesity 39.4% were participants who earn less than R1000 per month, 24.2% were of participants who earn R2000-R5000 per month, 16.7% were participants who earn R5000-R10000 per month and 19.7% were those participants earning more than R10000 per month. In participants with Class 2 obesity, participants who earn less than R1000 were having the highest prevalence of 39.4%. Class 3 obese participants were from those who earn R2000-5000 and those who earn more than R10000 **(Table 4.2).**

Table 4.2 Socio- demographic variables and BMI categories among residents of Tshikota location (N=318).

Socio-demographic variables	BMI classification						
	Underweight <18.5 kg/m^2 N (%)	Normal 18.5-24.9 kg/m^2 N (%)	Overweight 25-29.9 kg/m^2 N (%)	Class 1 Obese 30-34.9 kg/m^2 N (%)	Class 2 Obese 35-39.9 kg/m^2 N (%)	Class3 Obese ≥40 kg/m^2 N (%)	Total
Gender							
Male	2 (16.7)	55 (53.9)	52 (57.1)	35 (53)	23(51.1)	0 (0)	167
Female	10 (83.3)	47 (46.1)	39 (42.9)	31 (46.9)	22(48.9)	2 (100)	151
p-value= 0.79							
Age							
18.24	8 (66.7)	42 (41.2)	9 (9.9)	21 (31.8)	5 (11.1)	0 (0)	85
25-34	4 (33.3)	33 (32.4)	27 (29.7)	13 (19.7)	7 (15.6)	0 (0)	84
35-44	0 (0)	17 (16.7)	22 (24.2)	10 (15.2)	14(31.1)	1 (50)	64
45-54	0 (0)	5 (4.9)	23 (25.3)	15 (22.7)	15(33.3)	1 (50)	59
55+	0 (0)	5 (4.9)	10 (11)	7 (10.6)	4 (8.9)	0 (0)	26
p-value= 0.00							
Marital status							
Single	10 (83.3)	69 (67.6)	36 (39.6)	33 (50)	17(37.8)	1 (50)	166
Married	2 (16.7)	31 (30.4)	53 (58.2)	33 (50)	27 (60)	1 (50)	147
Divorced	0 (0)	2 (2)	0 (0)	0 (0)	0 (0)	0 (0)	2
Widow(er)	0 (0)	0 (0)	2 (2.2)	0 (0)	1 (2.2)	0 (0)	3
p-value= 0.00							
Educational status							
Tertiary	2 (16.7)	24 (23.5)	16 (17.6)	4 (6.1)	7 (15.6)	0 (0)	53
Secondary	10 (83.5)	51 (50)	40 (44)	38 (57.6)	13(28.9)	1 (50)	153
Primary	0 (0)	19 (18.6)	24 (26.4)	15 (22.7)	16(35.6)	1 (50)	75
None	0 (0)	8 (7.8)	11 (12.1)	9 (20)	9 (20)	0 (0)	37
p-value= 0.00							
Employment status							
Employed	6 (50)	51 (50)	58 (63.7)	35 (53)	39(86.7)	2 (100)	191
Unemployed	6 (50)	51 (50)	33 (36.3)	31 (47)	6 (13.3)	0 (0)	127
p-value= 0.00							
Income							
<R 1000	6 (50)	47 (46.1	34 (37.4)	26 (39.4)	9 (20)	0 (50)	122
R2-R5 000	6 (50)	28 (27.5)	31 (34.1)	16 (24.2)	12(26.7)	1 (50)	94
R5-R10 000	0 (0)	8 (7.8)	12 (13.2)	11 (16.7)	10(22.2)	0 (0)	41
>R10 000	0 (0)	19 (18.6)	14 ()15.4	13 (19.7)	14(31.1)	1 (50)	61
p-value= 0.00							
Total	12(3.8)	102(32.1)	91 (28.6)	66(20.8)	45(14.2)	2 (0.6)	318

4.2.2. Association between Lifestyle variables and BMI categories among residents of Tshikota Location.

Table 4.3 illustrates lifestyle variables and BMI categories. From the underweight participants in physical active all of them were not physical active. Of the participants who have normal weight 74.5% were no physical active and 25.5% were active. Non active participants were having the highest percentage in obesity (74.2% in Class 1 and 77.8% in Class 2 obesity) as well as in overweight (82.4%) compared to active participants (25.8% in Class1, 22.2% in Class 2 and 17.6% in overweight). Of the participants who are underweight in meals consumption per day, 83.3% are those who take meals 3 times a day and 16.7% takes meals 5 times a day. In participants who have normal weight 60.8% have meals 3 times a day, 22.5% have meals twice

a day and 16.7% have meals 4 times a day. In participants with overweight 61.5% have meals 3 times a day, 18.7% have meals twice and 4 times a day and only 1.2% have meals5 times a day. In obesity participants both in Class 1 and Class 2 obesity, participants who take meals 3 times a day have the highest percentage of 74.2% and 55.6%. Participants in Class 3 obese take meals twice and four times a day.

In fruits intake per week, 50% of the participants who were underweight take fruits daily, 33.3% take fruits 2-4 days a week and 16.7% take fruits 2-3 times per month. In participants who have normal weight, 14.7% take fruits daily, majority takes fruits 2-4 days a week (22.5%), 5-6 days a week (23.5% and 2-3 times per month(18.6%). In overweight participants 8.8% never take fruits in a week and only 12.1% takes fruits daily. In Class 1 obesity only 19.7% takes fruits daily and only 20% in Class 2 obesity takes fruits every day. Of the participants who are underweight in vegetable intake, 50% never take vegetable in a week and 16.7% take vegetables once a week, 2-3 times per month and less than 2 times per month. In normal weight participants most of them take vegetables 2-3 times per month (28.4%) while other vegetables less than 2 times per month (24.5%) and 23.5%never take vegetables in a week. In overweight participants 34.1% takes vegetables 2-3 times per month and 30.8% take vegetables less than 2 times per month while 11% never take vegetables. In Class 1 obesity most of the participants (30.3%) takes vegetables 2-3 times per month and 27.3% never take vegetables. In Class 2 obesity majority (35.6%) takes vegetables 2-3 times per month.

Most of the participants who are underweight takes sweets 2-4 days a week (33.3 %.). Majority of the participants who had normal weight take sweets once a week (29.4%) and 2-4 days a week (29.4). In participants who are overweight 39.6% take sweets once a week and 34.1% take sweets 2-4 days a week. In Class 1 obesity participants 34.8%% take sweets 2-4 days a week and participants who are in Class 3 obesity take sweets once a week. Of the participants who are underweight in soft drink intake, most of them take soft drinks everyday (33.3%) and 2-3 times per month (33.3%). In normal weight participants 32.4% take soft drinks once a week, 30.4% take soft drinks 2-4 days a week and 23.5% take soft drinks 5-6 days a week. In Class 1 obesity 15.2% take soft drinks daily, 24.2% takes soft drinks once a week, 22.7% takes soft drinks 2-4 days a week and 28.8% takes soft drinks 5-6 days a week. All participants who were in Class 3 obesity take soft drinks once a week. In fruit juice intake per week, 33.3% of those who are underweight never take fruit juice and 66.7% take fruit juice 2-3 times per month. In normal weight participants 35.3% takes fruit juice 2-3 times per month and 18.6% never take

fruit juice in a week. Only 2.2% in overweight participate takes fruit juice daily and 33% takes fruit juice 2-3 times per month. In obese participants none of them takes fruit juice every day.

Half of the participants in junk snacks intake who are underweight takes junk snacks 2-4 days a week. In normal weight participants 5.9% had junk snacks daily, 26.5% had junk snacks once a week, 23.5% had junk snacks 2-4 days a week, 16.7% had junk snacks 5-6 days a week and 17.6% had snacks 2-3 times per month. In overweight participants most participants had junk snacks once a week (27.5%) and 2-4 days a week (22%). In obesity participants, the highest percentage was on participates who takes junk snacks once a week both in Class 1 (28.8%) and in Class 2 obesity (31.1%). Participates who were in Class 3 obesity had junk snacks 2-4 days a week and 2-3 times per month. In participates who were underweight in Low fat product intake, 66.7% never took low fat product and in normal weight participants 59.8% never took low fat products. In overweight participants 50.5% never take low fat products. In obese participants 60.6% in Class 1 obesity never took low fat products, 57.8% participants in Class 2 obesity never took low fat products and all participants in Class 3 obesity never took low fat products. In terms of wholegrain bread/cereals intake per week, the highest percentage in underweight never took whole grain bread/cereals. In normal weight participants, overweight, Class 1, Class 2 and Class 3 obesity participates, have found to be in those participants who never take wholegrain bread/cereals.

In participants who were underweight in fried food intake, 33.3% took fried food once a week, 33.3% took fried food 2-4 days a week and 33.3% took fried food 5-6 days a week. In normal weight participants, most participates took fried food 2-4 days a week (31.4%) and 5-6 days a week (29.4%). In overweight participants 36.3% took fried food once a week, 30.8% took fried food 2-4 days a week and only 4.4% took fried food less than 2 times per month. In Class 1 obesity 3 % took fried food daily and 33.3% took fried food once a week. In Class 2 obesity 2.2% took fried food daily. In Class 3 obesity one participant took fried food daily while the other participate took fried food 5-6 days a week. Half of the underweight participants took fast food once a week. In normal weight 35.3% took fast food 2-3 times per month and only 2% took fast food daily. In overweight participants, most of the participants (40.7%) took fast food 2-3 times per month. Most of the participants in Class 1 obesity (33.3%) and Class 2 obesity (42.2%) were found to be taking fast food 2-3 times per month. In breakfast consumption in a week, 33.3% in underweight participants eat breakfast 5-6 days a week. In normal weight participants most

participants eat their breakfast 2-4 days a week (28.4%) and 5-6 days a week (23.5%). Only 24.5% ate breakfast daily. In overweight participants majority (38.5%) ate breakfast 5-6 days a week and only 18.7% ate breakfast daily. In Class1 obesity 16.7% never ate breakfast and most of participates (40%) ate breakfast 5-6 days a week. Of the participants who are in Class 3 obesity one participant ate breakfast daily and the other ate breakfast 5-6 days a week.

Table 4.3 Lifestyle variables and BMI categories among residents of Tshikota location (N=318).

Lifestyle variables	BMI classification						
	Underweight <18.5 kg/m^2 N (%)	**Normal 18.5-24.9 kg/m^2 N (%)**	**Overweight 25-29.9 kg/m^2 N (%)**	**Class 1 Obese 30-34.9 kg/m^2 N (%)**	**Class 2 Obese 35-39.9 kg/m^2 N (%)**	**Class3 Obese ≥40 kg/m^2 N (%)**	**Total**
Physical active							
Active	0 (0)	26(25.5)	16 (17.6)	17 (25.8)	10(22.2)	1 (50)	70
Inactive	12(100)	76(74.5)	75 (82.4)	49 (74.2)	35(77.8)	1 (50)	248
p-value= 0.47							
Meal consumption/day							
Never	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
Once	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
Twice	0 (0)	23(22.5)	17 (18.7)	3 (4.5)	8 (17.8)	1 (50)	52
Three times	10(83.3)	62(60.8)	56 (61.5)	49 (74.2)	25(55.6)	0 (0)	202
Four times	0 (0)	17(16.7)	17 (18.7)	12 (18.2)	12(26.7)	1 (50)	59
Five times	2 (16.7)	0 (0)	1 (1.2)	2 (3)	0 (0)	0 (0)	5
p-value= 0.19							
Fruits consumption (f/wk)							
Never	0 (0)	2 (2)	8 (8.8)	3 (4.5)	1 (2.2)	0 (0)	14
Daily	6 (50)	15(14.7)	11 (12.1)	13 (19.7)	9 (20)	0 (0)	54
Once a week	0 (0)	11(10.8)	14 (15.4)	7 (10.6)	5 (11.1)	1 (50)	38
2-4 days a week	4 (33.3)	23(22.5)	18 (19.8)	17 (25.8)	11(24.4)	0 (0)	73
5-6 days a week	0 (0)	24(23.5)	19 (20.9)	10 (11)	11(24.4)	1 (50)	65
2-3 times per month	2 (16.7)	19(18.6)	10 (11)	12 (18.2)	7 (15.6)	0 (0)	50
<2 times per month	0 (0)	8 (7.8)	11 (12.1)	4 (6.1)	1 (22)	0 (0)	24
p-value= 0.54							
Vegetable consumption (f/wk)							
Never	6 (50)	24(23.5)	10 (11)	18 (27.3)	6 (13.3)	0 (0)	0
Daily	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	60
Once a week	2 (16.7)	17(16.7)	9 (9.9)	8 (12.1)	4 (8.9)	0 (0)	40
2-4 days a week	0 (0)	7 (6.9)	9 (9.9)	5 (7.6)	11(24.4)	0 (0)	32
5-6 days a week	0 (0)	0 (0)	4 (4.4)	3 (4.5)	0 (0)	0 (0)	7
2-3 times per month	2 (16.7)	29(28.4)	31(34.1)	20 (30.3)	16(35.6)	0 (0)	98
<2 times per month	2 (16.7)	25(24.5)	28 (30.8)	12 (18.2)	8 (17.8)	1 (100)	77
p-value= 0.22							
Sweets intake (f/wk)							
Never	2 (16.7)	7 (6.9)	4 (4.4)	5 (7.6)	4 (8.9)	0 (0)	22
Daily	2 (16.7)	8 (7.8)	4 (4.4)	3 (4.5)	3 (6.7)	0 (0)	20
Once a week	0 (0)	30(29.4)	36 (39.6)	12 (18.2)	11(24.4)	2 (100)	91
2-4 days a week	4 (33.3)	30(29.4)	31 (34.1)	23 (34.8)	11(24.4)	0 (0)	99
5-6 days a week	2 (16.7)	15(14.7)	3 (3.3)	14 (21.2)	7 (15.6)	0 (0)	41
2-3 times per month	2 (16.7)	12(11.8)	12 (13.2)	6 (9.1)	7 (15.6)	0 (0)	39
<2 times per month	0 (0)	0 (0)	1 (1.1)	3 (4.5)	2 (4.4)	0 (0)	6
p-value= 0.22							
Soft drinks intake (f/wk)							
Never	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
Daily	4 (33.3)	2 (2)	4 (4.4)	10 (15.2)	6 (13.3)	0 (0)	26
Once a week	0 (0)	33(32.4)	24 (26.4)	16 (24.2)	12(26.7)	2 (100)	87
2-4 days a week	2 (16.7)	31(30.4)	23 (22.5)	15 (22.7)	11(24.4)	0 (0)	82
5-6 days a week	2 (16.7)	24(23.5)	22 (24.2)	19 (28.8)	13(28.9)	0 (0)	80
2-3 times per month	4 (33.3)	12(11.8)	18 (19.8)	6 (9.1)	3 (6.7)	0 (0)	43
<2 times per month	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
p-value= 0.10							
Fruit Juice Intake (f/wk)							
Never	4 (33.3)	19(18.6)	17 (18.7)	13 (19.7)	3 (6.7)	0 (0)	56
Daily	0 (0)	2 (2)	2 (2.2)	0 (0)	0 (0)	0 (0)	4

Once a week	0 (0)	15(14.7)	12 (13.2)	14 (21.2)	7 (15.6)	1 (50)	49
2-4 days a week	0 (0)	11(10.8)	8 (8.8)	10 (15.2)	7 (15.6)	0 (0)	36
5-6 days a week	0 (0)	4 (3.9)	6 (6.6)	1 (1.5)	2 (4.4)	0 (0)	13
2-3 times per month	8 (66.7)	36(35.3)	30 (33)	18 (27.3)	12(26.7)	0 (0)	104
<2 times per month	0 (0)	15(14.7)	16 (17.6)	10 (15.2)	14(31.1)	1 (50)	56
p-value= 0.22							
Junk snacks Intake (f/wk)							
Never	0 (0)	3 (2.9)	5 (5.5)	5 (7.6)	1 (2.2)	0 (0)	14
Daily	0 (0)	6 (5.9)	9 (9.9)	7 (10.6)	3 (6.7)	0 (0)	25
Once a week	2 (16.7)	27(26.5)	25 (27.5)	13 (4.5)	10(22.2)	0 (0)	77
2-4 days a week	6 (50)	24(23.5)	20 (22)	19 (28.8)	14(31.1)	1 (50)	84
5-6 days a week	4 (33.3)	17(16.7)	10 (11)	7 (10.6)	8 (17.8)	0 (0)	46
2-3 times per month	0 (0)	18(17.6)	19 (20.9)	9 (13.6)	6 (13.3)	1 (50)	53
<2 times per month	0 (0)	7 (6.9)	3 (3.3)	6 (9.1)	3 (6.7)	0 (0)	19
p-value= 0.54							
Low fat milk/dairy products Intake (f/wk)							
Never	8 (66.7)	61(59.8)	46 (50.5)	40 (60.6)	26(57.8)	2 (100)	183
Daily	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
Once a week	0 (0)	2 (2)	7 (7.7)	0 (0)	1 (2.2)	0 (0)	10
2-4 days a week	0 (0)	0 (0)	1 (1.1)	1 (1.5)	0 (0)	0 (0)	2
5-6 days a week	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
2-3 times per month	2 (16.7)	14(13.7)	20 (22)	13 (19.7)	7 (15.6)	0 (0)	56
<2 times per month	2 (16.7)	25 (24)	17 (18.7)	12 (18.2)	11(24.4)	0 (0)	67
p-value= 0.97							
Whole grain bread/cereals consumption (f/wk)							
Never	6 (50)	71(61.6)	61 (67)	52 (78.8)	32(71.1)	2 (100)	224
Daily	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
Once a week	0 (0)	1 (1)	2 (2.2)	2 (3)	2 (4.4)	0 (0)	7
2-4 days a week	2 (16.7)	3 (2.9)	1 (1.1)	1 (1.5)	2 (2.2)	0 (0)	8
5-6 days a week	0 (0)	6 (5.9)	3 (3.3)	2 (3)	2 (4.4)	0 (0)	13
2-3 times per month	2 (16.7)	11(10.8)	14 (15.4)	2 (3)	4 (8.9)	0 (0)	33
<2 times per month	2 (16.7)	10 (9.8)	10 (11)	7 (10.6)	4 (8.9)	0 (0)	33
p-value= 0.12							
Fried food Intake (f/wk)							
Never	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
Daily	0 (0)	0 (0)	0 (0)	2 (3)	1 (2.2)	1 (0)	4
Once a week	4 (33.3)	21(20.6)	33 (36.3)	16 (24.2)	12(26.7)	0 (0)	86
2-4 days a week	4 (33.3)	32(31.4)	28 (30.8)	22 (33.3)	12(26.7)	0 (0)	98
5-6 days a week	4 (33.3)	30(29.4)	13 (14.3)	12 (18.2)	9 (20)	1 (50)	69
2-3 times per month	0 (0)	11(10.8)	13 (14.3)	12 (18.2)	7 (15.6)	0 (0)	43
<2 times per month	0 (0)	8 (7.8)	4 (4.4)	2 (3)	4 (8.9)	0 (0)	18
p-value= 0.78							
Fast food intake (f/wk)							
Never	0 (0)	0 (0)	6 (6.6)	2 (3)	0 (0)	0 (0)	8
Daily	0 (0)	2 (2)	1 (1.1)	2 (3)	0 (0)	0 (0)	5
Once a week	6 (50)	13(12.7)	18 (8.8)	18 (27.3)	10(22.2)	1 (50)	66
2-4 days a week	2 (16.7)	16(15.7)	13 (14.3)	8 (12.1)	10(22.2)	0 (0)	49
5-6 days a week	0 (0)	18(17.6)	4 (3.9)	5 (7.6)	1 (2.2)	0 (0)	28
2-3 times per month	2 (16.7)	36(35.3)	37 (40.7)	22 (33.3)	19(42.2)	1 (50)	117
<2 times per month	2 (16.7)	17(16.7)	12 (13.2)	9 (13.6)	5 (11.1)	0 (0)	45
p-value= 0.40							
Breakfast consumption (f/wk)							
Never	2 (16.7)	13(12.7)	12 (13.2)	11 (16.7)	8 (17.8)	0 (0)	46
Daily	2 (16.7)	25(24.5)	17 (18.7)	10 (15.2)	6 (13.3)	1 (50)	61
Once a week	2 (16.7)	11(10.8)	13 (14.3)	9 (13.6)	8 (17.8)	0 (0)	43
2-4 days a week	2 (16.7)	29(28.4)	14 (15.4)	13 (19.7)	5 (11.1)	0 (0)	63
5-6 days a week	4 (33.3)	24(23.5)	35 (38.5)	22 (33.3)	18(40)	1 (0)	104
2-3 times per month	0 (0)	0 (0)	0 (0)	1 (1.5)	0 (0)	0 (0)	1
<2 times per month	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
p-value= 0.48							

f/wk= Frequency per week.

4.2.3 Association between Sedentary behavior variables and BMI categories among residents of Tshikota Location.

In screen time behaviour half of the participants who were underweight watch/play video games 4 hours per day. In normal weight participants' majority watch TV/play video games for 4 hours (34.3%) and 5/more hours (29.4%) same as in overweight (27.5% and 26.4%) and Class 1 obesity (39.4% and 27.3%). In Class 2 obesity most of the participant watch TV/play video game for 3 hours (24.4%) and 4 hours (28.9%). All participants who have Class 3 obesity watch TV/play video games 5/more hours per day. In terms of the source of transport, in underweight participants 66.7% use bus/taxi as a source of transport to their destinations, 16.7% use foot and 16.7% use their own car. In normal weight participants half of the participants (50%) use bus/taxi to their destinations, 24.5% use their foot while 25.5% use their car to their destination. Majority of participants (61.5%) who are overweight uses bus/taxi to their destination and 31.9% uses their car and only 6.6% use their foot. In participants with obesity majority use bus/taxi (54.3% in Class 1, 51.1% in Class 2 and 50% in Class 3) and cars (22.7, 42.2 and 50%) as their source of transport to their destinations.

In distance covered by participants to their destination, 33.3% of those who are underweight travel less than 3km and 66.7% travel 5km. In normal weight participants majority of the participants travel less than 3km (41.2%) and 5km (48%). In overweight participants only 6.6% travel 10km, 49.5% travel 5km and 44% travel less than 3km to their destination. In Class 1 obesity only 1.5% travel 10km and the other travel 5km (42.4%) and less than 3km (56.1%). In Class 2 obesity 4.4% travel 10km to their destination, 44.4% travel 5km and 51.1% travel less than 3km to their destination. In Class 3 obesity 50% travel less than 3km to their destination and 50% travel 5km. in time taken to destinations in participants who are underweight, 33.3% take less than 5 minutes and 66.7% and take 5-15 minutes to their destination. In normal weight 25.5% take less than 5 minutes to their destination, 54.9% take 5-15 minutes, 8.8% take 16-30 minutes and 10.8% take 31 minutes -1 hour. In overweight participants majority (68.1%) take 5-15 minutes to their destinations. In Class 1 and Class 2 obesity participants, majority (69.7% and 88.9%) take 5-15 minutes to their destinations. Of the participants who are overweight in those who eat while watching TV, 83.3% eat while watching TV while 16.7% do not eat while watching TV. Of those who have normal weight majority (75.5%) do not eat while watching TV. In overweight participants 28.6% do not eat while watching TV. In Class 1 obesity 71.2% do not eat while watching TV and in Class 2 obesity 35.6% eat while watching TV and all participants in Class3 obesity do not eat while watching TV **(Table 4.4)**.

Table 4.4 Sedentary lifestyle variables and BMI categories among residents of Tshikota location (N=318).

Sedentary behaviour variables	BMI classification						
	Underweight <18.5 kg/m^2 N (%)	Normal 18.5-24.9 kg/m^2 N (%)	Overweight 25-29.9 kg/m^2 N (%)	Class 1 Obese 30-34.9 kg/m^2 N (%)	Class 2 Obese 35-39.9 kg/m^2 N (%)	Class3 Obese ≥40 kg/m^2 N (%)	Total
Screen time(TV viewing and computer use) (hour/day)							
Never	0 (0)	0 (0)	3 (3.3)	2 (3)	0 (0)	0 (0)	5
<1 hour	0 (0)	2 (2)	2 (2.2)	3 (4.5)	1 (2.2)	0 (0)	8
I hour	0 (0)	11(10.8)	7 (7.7)	4 (6.1)	4 (8.9)	0 (0)	26
2 hours	4 (33.3)	9 (8.8)	17 (18.7)	2 (3)	9 (20)	0 (0)	41
3 hours	0 (0)	15(14.7)	13 (14.3)	11 (16.7)	11(24.4)	0 (0)	50
4 hours	6 (50)	35(34.3)	25 (27.5)	26 (39.4)	13(28.9)	0 (0)	105
5/more hours	2 (16.7)	3 (29.4)	24 (26.4)	18 (27.3)	7 (15.6)	2 (100)	83
p-value= 0.42							
Mode of transport used							
Foot	2 (16.7)	25(24.5)	6 (6.6)	13 (19.7)	3 (6.7)	0 (0)	49
Bicycle	0 (0)	0 (0)	0 (0)	2 (3)	0 (0)	0 (0)	2
Bus/taxi	8 (66.7)	51 (50)	56 (61.5)	36 (54.5)	23(51.1)	1 (50)	175
Car	2 (16.7)	26(25.5)	29 (31.9)	15 (22.7)	19(42.2)	1 (50)	92
p-value= 0.02							
Distance covered							
<3 km	4 (33.3)	42(41.2)	40 (44)	37 (56.1)	23(51.1)	1 (50)	147
5 km	8 (66.7)	49 (48)	45 (49.5)	28 (42.4)	20(44.4)	1 (50)	151
10 km	0 (0)	9 (8.8)	6 (6.6)	1 (1.5)	2 (4.4)	0 (0)	18
>10 km	0 (00	2 (2)	0 (0)	0 (0)	0 (0)	0 (0)	2
p-value= 0.18							
Time taken							
<5 minutes	4 (33.3)	26(25.5)	19 (20.9)	17 (25.8)	3 (6.7)	1 (50)	70
5-15 minutes	8 (66.7)	56(54.9)	62 (68.1)	46 (69.7)	40(88.9)	1 (50)	213
16-30 minutes	0 (0)	9 (8.8)	4 (4.4)	3 (4.5)	0 (0)	0 (0)	16
31 minutes-1 hour	0 (0)	11(10.8)	6 (6.6)	0 (0)	2 (4.4)	0 (0)	19
p-value= 0.48							
Eating while watching TV							
Yes	10(83.3)	25(24.5)	26 (28.6)	19 (28.8)	16(35.6)	0 (0)	96
No	2 (16.7)	77(75.5)	65 (71.4)	47 (71.2)	29(64.4)	2 (100)	222
p-value= 0.60							
Physical active							
Active	0 (0)	26(25.5)	16 (17.6)	17 (25.8)	10(22.2)	1 (50)	22
Inactive	12(100)	76(74.5)	75 (82.4)	49 (74.2)	35(77.8)	1 (50)	78
p-value= 0.47							

4.2.4 Association between Neighborhoods environmental variables and BMI categories among residents of Tshikota location.

In access to commercial places and BMI categories, 83.3% of the participants who were underweight have no access to commercial places and 16.7% of the participants have access to commercial places. In normal weight participants 25.5% have access to commercial places and 74.55 did not have access to commercial places. 75.8% of overweight participants did not have access to commercial places. In Class 1 obesity participants 21.2% have access to commercial places and in Class 2 obesity participants 44.4% have access to commercial places. In Class 3 obesity all participants did not have access to commercial places. In access to non-residential places, only 16.7% of underweight participants have access to non-residential places.

Majority of the participants in all BMI categories (81.4% in overweight, 72.5% in normal weight, 84.8% in Class 1 obesity, 93.3% in Class 2 obesity and 100% in Class 3 obesity) have no access to non-residential places. In Public transport access, majority of the participants in BMI categories (100% in underweight, 100% in normal weight, 100% in overweight, 100% in Class 1 obesity, 97.8 in Class 2 obesity and 100% in Class 3 obesity) have access to public transport. In case of the presence of recreation facilities majority of the participants in BMI categories (100% in underweight, 95.1% in normal weight, 97.8% in overweight, 98.5% in Class 1 obesity, 100% in Class 2 obesity and 100% in Class 3 obesity) have no presence to recreational facilities.

In presence of pedestrian pathway, 16.7% of the participants who are underweight have presence of pedestrian pathway, 70% participants in normal weight have presence of pedestrian pathway. In overweight participants 78% have no presence of pedestrian pathway and 22% have presence of pedestrian pathway. In Class 1 obesity 71.2% have no presence of pedestrian pathway and in Class 2 obesity participants 71.1% have no presence of pedestrian pathway. In Class 3 obesity participants. In seeing people active, 83.3% of the participants who are underweight never saw people active. In normal weight participants 25.5% have seen people active and 18.7% in overweight participants have seen people active. In participants with Class 1 obesity, 87.9% have not seen people active, in participants with Class 2 obesity 91.1% have not seen people active and all participants in Class 3 obesity have never seen people active. In connective of streets, all participants who are underweight have connective of streets, 89.2% of normal weight participants have connective of streets and in overweight participants 82.4% have connective of streets. In Class 1 obesity participants 12.1% have connective of streets and in Class 2 obesity participants 8.9% have connective of streets. 83.3% of underweight participants have no traffic safety of bicycling and 16.7% have traffic safety of

bicycling. In normal weight participants 88.2% have no traffic safety of bicycling and 97.8% of overweight participant have no traffic safety of bicycling. In Class 1 obesity participants 12.1% have traffic safety for bicycling and in Class 2 obesity participants 17.8% have traffic safety of bicycling.

In traffic safety for walking, 16.7% in underweight participants have traffic safety for walking and in normal weight participants 48% have traffic safety of walking. In overweight participants 46.2% have traffic safety for walking, in Class1 obesity participants 42.4% have traffic safety for walking and in Class 2 obesity participants 42.2% have traffic safety for walking and all participants in Class 3 obesity have on traffic safety for walking. In fruits and vegetable access and BMI categories, majority of the participants in BMI categories (83.3% in underweight, 87.3% in normal weight, 75.8% in overweight, 95.5% in Class 1 obesity, 91.1 in Class 2 obesity and 100% in Class 3 obesity) have no access to fruits and vegetables. In crime safety during the day, majority of participants in BMI categories (83.3% in underweight, 97.1% in normal weight, 86.8% in overweight, 95.5% in Class 1 obesity, 100% in Class 2 obesity and 100% in Class 3 obesity) have experience crime safety during the day and in crime safety at night majority of the participants in BMI categories (100% in underweight, 89.2% in normal weight, 100% in overweight, 93.9% in Class 1 obesity, 95.6 in Class 2 obesity and 100% in Class 3 obesity)experience no safety at night **(Table 4.5)**

Table 4.5 Neighborhoods Environmental variables and BMI categories among residents of Tshikota location (N=318).

Neighborhoods Environmental variables	BMI classification						
	Underweight <18.5 kg/m^2 N (%)	Normal 18.5-24.9 kg/m^2 N (%)	Overweight 25-29.9 kg/m^2 N (%)	Class 1 Obese 30-34.9 kg/m^2 N (%)	Class 2 Obese 35-39.9 kg/m^2 N (%)	Class3 Obese ≥40 kg/m^2 N (%)	Total
Access to commercial places							
Yes	2 (16.7)	26 (25.5)	22 (24.2)	14(21.2)	20(44.4)	0 (0)	84
No	10(83.3)	76 (74.5)	69 (75.8)	52(78.8)	25(55.6)	2 (100)	234
p-value= 0.11							
Access to non-residential places							
Yes	2 (16.7)	19 (18.6)	25 (27.5)	10(15.2)	3 (6.7)	0 (0)	59
No	10(83.3)	83 (81.4)	66 (72.5)	56(84.8)	42(93.3)	2 (100)	259
p-value= 0.08							
Access to public transport							
Yes	12 (100)	102 (100)	91 (100)	66 (100)	44(97.8)	2 (100)	317
No	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.2)	0 (0)	1
p-value= 0.10							
Presence of recreational facilities							
Yes							
No	0 (0)	5 (4.9)	2 (2.2)	1 (1.5)	0 (0)	0 (0)	8
p-value= 0.12	12 (100)	97 (95.1)	59 (97.8)	67(98.5)	45 (100)	2 (100)	310
Presence of pedestrian pathways							
Yes							
No	2 (16.7)	30 (29.4)	20 (22)	19(28.8)	13(28.9)	1 (50)	85
p-value= 0.63	10(83.3)	72 (70.6)	71 (78)	47(71.2)	32(6.7)	1 (50)	233
Seeing people active							
Yes	2 (16.7)	26 (25.5)	17 (18.7)	8 (12.1)	4 (8.9)	0 (0)	57
No	10(83.3)	76 (25.5)	74 (81.3)	58(87.9)	41(91.1)	2 (100)	261
p-value= 0.01							
Connectivity of streets							
Yes	12 (100)	91 (89.2)	75 (82.4)	58(87.9)	41(97.1)	1 (50)	278
No	0 (0)	11 (10.2)	16 (17.6)	8 (12.1)	4 (8.9)	1 (50)	40
p-value= 0.61							
Traffic safety for bicycling							
Yes	2 (16.7)	12 (11.8)	2 (2.2)	8 (12.1)	8 (17.8)	1 (50)	33
No	10(83.3)	90 (88.2)	89 (97.8)	58(87.9)	37(82.2)	1 (50)	285
p-value= 0.24							
Traffic safety for walking							
Yes	2 (16.7)	49 (48)	42 (46.2)	28(42.4)	19(42.2)	0 (0)	140
No	10(83.3)	53 (52)	49 (53.8)	38(57.6)	26(57.8)	2 (100)	178
p-value= 0.78							
Access to fruits and vegetables							
Yes	2 (16.7)	13(12.7)	22(24.2)	3 (4.5)	4 (8.9)	0 (0)	44
No	10(83.3)	89(87.3)	69(75.8)	63(95.5)	41(91.1)	2 (100)	274
p-value= 0.12							
Crime safety during the day							
Yes	10(83.3)	99 (97.1)	79 (86.8)	63(95.5)	45(100)	2 (100)	297
No	2 (16.7)	3 (2.9)	13 (14.3)	3 (4.5)	0 (0)	0 (0)	21
p-value= 0.21							
Crime safety at night							
Yes	0 (0)	11(10.8)	0 (0)	4 (6.1)	2 (4.4)	0 (0)	17
No	12(100)	91(89.2)	91 (100)	62(93.9)	43(95.6)	2 (100)	301
p-value= 0.13							

4.2.5 Association between Psychological variables and Body Mass Index (BMI) categories among residents of Tshikota location.

Table 4.6 illustrates psychological variables and BMI categories among residents of Tshikota Location. In underweight participants, 66.7% of the participants never eat while worried, 60.8% of normal weight participants also never eat while worried. Most of the participants (59.3%) of overweight participants never eat when worried. In obesity participants 17.6% in Class 1 obesity always eat when worried and in Class 2 obesity only 8.9% always eat when worried. 66.7% of participants who are underweight never eat when they are angry and 33.3% always eat when they are angry. In normal weight participants 56.9% never eat when they are angry. In overweight participants 48.6% never eat when they are angry. 80% of participants with Class 2 obesity never eat when they are angry. 83.3% of the participants who are underweight always treat themselves with food after doing something well. In normal weight participants 54.9% treat themselves with food after doing something well. In overweight participants 40.7% sometimes treat themselves with food and 38.5% always treat themselves with food after doing something well. 43.9% of Class 1 obesity participants always treat themselves with food and 42.4% sometimes treat themselves with food after doing something well. 48.9% of participants with Class 2 obesity sometimes treat themselves with food while 42.2% always treat themselves with food after doing something well.

Of the participants who are underweight 66.7% sometimes eat when they are happy and in normal weight participants 39.2% sometimes eat when they are happy. Of the overweight participants 42.9% sometimes eat when they are happy and 31.9% always eat when they are happy. In Class 1 obesity 9.1% always eat when they are happy while in Class 2 obesity 22.2% always eat when they are happy. 66.6% of the participants who are underweight never eat when they are bored and in normal weight participants 38.2% never eat when they are bored and 34.3% sometimes eat when they are bored. In participants who are overweight 48.4% sometimes eat when they are bored and only 9.9% always eat when they are bored. In participants with Class 1 obesity 45.5% never eat when they are bored and in Class 2 obesity only 17.8% always eat when they are bored. In underweight participants those who never eat when stressed were 16.7% and in normal weight participants were 41.2%. In overweight participants 41.8% never eat when stressed and in Class 1 obesity39.4% never eat when stressed while in Class 2 obesity 40% never eat when stressed. In Class 3 obesity all participants always eat when stressed. In lonely participants who are underweight 50% never eat when feeling lonely. In normal weight participants 40.2% never eat when feeling lonely and

37.3% sometimes eat when feeling lonely. 49.5% of overweight participants sometimes eat when they are lonely.

Table 4.6 Association between Psychological variable and Body Mass Index (BMI) categories among residents of Tshikota location (N=318).

Psychological variables	BMI classification						
	Underweight <18.5 kg/m^2 N (%)	Normal 18.5-24.9 kg/m^2 N (%)	Overweight 25-29.9 kg/m^2 N (%)	Class 1 Obese 30-34.9 kg/m^2 N (%)	Class 2 Obese 35-39.9 kg/m^2 N (%)	Class3 Obese ≥40 kg/m^2 N (%)	Total
When I am worried I eat too much							
Never							
Sometimes	8 (66.7)	62(60.8)	54 (59.3)	30(45.5)	18(40)	1 (50)	173
Always	2 (16.7)	30(29.4)	21 (23.1)	27(40.9)	23(51.1)	0 (0)	103
p-value= 0.04	2 (16.7)	10 (9.8)	16 (17.6)	9 (13.6)	4 (8.9)	1 (50)	42
I eat when I am angry							
Never	8 (66.7)	58(56.9)	44 (48.4)	27(40.9)	36(80)	1 (50)	174
Sometimes	4 (33.3)	34(33.3)	28 (30.8)	26(39.4)	9 (20)	1 (50)	102
Always	0 (0)	10 (9.8)	19 (20.9)	13(19.7)	0 (0)	0 (0)	42
p-value= 0.49							
When I do something well I give myself food treat							
Never	0 (0)	10 (9.8)	25 (27.5)	9 (13.6)	4 (8.9)	0 (0)	48
Sometimes	2 (16.7)	36(35.3)	31 (40.7)	28(42.4)	22(48.9)	1 (50)	120
Always	10(83.3)	56(54.9)	35 (38.5)	29(43.9)	19(42.2)	1 (50)	150
p-value= 0.09							
When I am happy I eat more							
Never	2 (16.7)	39(38.2)	23 (25.3)	37(56.1)	16(35.6)	0 (0)	117
Sometimes	8 (66.7)	40(39.2)	39 (42.9)	23(34.8)	19(42.2)	1 (50)	130
Always	2 (16.7)	23(22.5)	29 (31.9)	6 (9.1)	10(22.2)	1 (50)	71
p-value= 0.22							
When I am bored I eat more							
Never	8 (66.7)	39(38.2)	38 (41.8)	30(45.5)	18(48)	0 (0)	133
Sometimes	0 (0)	35(34.3)	44 (48.4)	21(31.8)	19(42.2)	1 (50)	120
Always	4 (33.3)	28(27.5)	9 (9.9)	15(22.7)	8 (17.8)	1 (50)	65
p-value= 0.73							
I eat a lot when I am stressed							
Never	2 (16.7)	42(41.2)	38(41.8)	26(39.4)	18(40)	0 (0)	126
Sometimes	10(83.3)	42(41.2)	29(31.9)	28(42.4)	14(31.1)	0 (0)	123
Always	0 (0)	18(17.6)	24(26.4)	12(18.2)	13(28.9)	2 (100)	69
p-value= 0.29							
When I am feeling lonely I eat more							
Never							
Sometimes	6 (50)	41(40.2)	24(26.4)	26(39.4)	16(35.6)	1 (50)	114
Always	2 (16.7)	38(37.5)	45(49.5)	26(39.4)	23(51.1)	1 (50)	135
p-value= 0.60	4 (33.3)	23(22.5)	22(24.2)	14(21.1)	6 (13.3)	0 (0)	69

4.2.6. Association between Family history variables and Body Mass Index (BMI) categories among residents of Tshikota location.

Table 4.7 shows the association between family history and BMI categories. In participants who are underweight, 16.7% have obese relatives. In normal weight participants 88.2% do not have close blood relatives. In overweight participants 31.9% have close blood relatives who are obese. 53% of the participant with Class 1 obesity have obese close blood relatives and 86.7% in Class 2 obesity have close blood obese relative. All participants in Class 3 obesity have close blood relatives.

Table 4.7 Family history variables and Body Mass Index (BMI) categories among residents of Tshikota location (N=318).

Family history variable	BMI classification						
	Underweight <18.5 kg/m^2 N (%)	Normal 18.5-24.9 kg/m^2 N (%)	Overweight 25-29.9 kg/m^2 N (%)	Class 1 Obese 30-34.9 kg/m^2 N (%)	Class 2 Obese 35-39.9 kg/m^2 N (%)	Class3 Obese ≥40 kg/m^2 N (%)	Total
Do you have a blood relative who is obese							
Yes	2 (16.7)	1 (11.8)	29(31.9)	35 (53)	39(86.7)	2 (100)	119
No	10(83.3)	9 (88.2)	62(68.1)	31 (47)	6 (13.3)	0 (0)	199
p-value= 0.00							

4.3 Association between Health consequences variables and BMI categories among residents of Tshikota location.

Table 4.8 illustrates the association between Health consequences variables and BMI categories among residence of Tshikota Location. Participants who have normal Blood Pressure were 194 (61%), those who were Pre-hypertensive were 92(28.9) and 32 (10.1%) were in Stage 1 Hypertension. Of the participants with Class 1 obesity, 43.9% were having normal BP, 40.9% were pre-hypertensive and 15.2% were in Stage 1 Hypertension. In Class 2 obesity, 35.2% of the participants were having normal BP, 37.8% were Pre-hypertensive and 26.7% were in Stage 1 hypertension. With participants with Class 3 obesity, one was having normal BP and the other was Pre-hypertensive. The results shows that there was scientifically significant difference between BMI and blood pressure among participants (p-value=0.00).

In Glucose levels, majority of the participants 289 (90.3%) were having normal glucose. In obesity participants 90.9% in Class 1 obesity were having normal glucose level, 6.1% were at

high risk and 3% were at very high risk of glucose levels. In Class 2 obesity 8.9% of the participants were at high risk and 8.9% were at very high risk of glucose level. All participants in Class 3 obesity were having normal glucose level. In terms of cholesterol levels, 236 (74.2%) of the participants were having normal cholesterol levels, 65 (20.4%) were at borderline and 17(5.3%) were at high risk. In participants with obesity, 6.1%in Class 1 obesity were at high risk while 2.2% in Class 2 obesity were at high risk. Of the participants with Class 3 obesity one participant was having normal cholesterol level and the other participant was at borderline. There was no significant difference in BMI and cholesterol levels among participants (p-value= 0.20).

Table 4.8 Health consequences variables and BMI categories among residents of Tshikota location (N=318).

Health consequences variables	**BMI classification**						
	Underweight <18.5 kg/m^2 N (%)	**Normal 18.5-24.9 kg/m^2 N (%)**	**Overweight 25-29.9 kg/m^2 N (%)**	**Class 1 Obese 30-34.9 kg/m^2 N (%)**	**Class 2 Obese 35-39.9 kg/m^2 N (%)**	**Class3 Obese ≥40 kg/m^2 N (%)**	**Total**
Blood pressure (mm Hg)							
Normal BP **(≤120 /80)**	8(66.7)	81(79.4)	59 (64.8)	29 (43.9)	16(35.6)	1 (50)	194
Prehypertension**(120-139/80-89)**	4(33.3)	15(14.7)	28 (30.8)	27 (40.9)	17(37.8)	1 (50)	92
Stage 1 hypertension **(140-159/90-99)**	0 (0)	6 (5.9)	4 (4.4)	10 (15.2)	12(26.7)	0 (0)	32
Stage 2 hypertension **(≥160/100)**	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
p-value= 0.00							
Glucose level (mmol/l)							
Normal **(<3.9-5.5)**	12(100)	94(92.2)	82 (90)	60 (90.9)	37(82.2)	2 (100)	287
High Risk **(5.6-7.0)**	0 (0)	8 (7.8)	9 (9.9)	4 (6.1)	4 (8.9)	0 (0)	25
Very High Risk **(≥7.0)**	0 (0)	0 (0)	0 (0)	2 (3)	4 (8.9)	0 (0)	6
p-value= 0.01							
Cholesterol level (mmol/l)							
Normal **(<5.2)**	10(83.3)	83(81.4)	59 (64.8)	52 (78.8)	37(68.9)	1 (50)	236
Borderline **(5.2-6.2)**	2 (16.7)	17(16.7)	22 (24.2)	10 (15.2)	13(28.9)	1 (50)	65
High Risk **(≥6.2)**	0 (0)	2 (2)	10 (11)	4 (6.1)	1 (2.2)	0 (0)	17
p-value= 0.20							

CHAPTER 5

DISCUSSION OF STUDY FINDINGS

5.1 Introduction

Research findings are summarized and presented within the framework of the research objectives

5.2 Prevalence of Obesity

This study reveals the existence of higher prevalence of obesity (35.5%) and overweight (28.6%) among the study sample. A study conducted by Skaal et al.,(2011) on Health Care workers, reported a higher prevalence of 75% overweight and obesity. In another study on South Africa hypertension guideline in Bloemfontein by Seedat and Rayner (2011), reported the prevalence of overweight and obesity to be higher with 32% of overweight participants and 44% being obese. Duncan et al., (2014) in their study on Determinants of obesity and perception of weight in Hypertensive patients in rural South Africa, reported a slightly similar prevalence of 28% of participants who were overweight and 34% who were obese. The prevalence of obesity was found to be higher in males (51.3%) than females (46.7%), males also showed high prevalence in overweight (57.1%) than females (42.9%). The results concur with those that were found by Muluvhu, Mukoma, Amusa, Goon and Delport, 2014 in their study on Screening for components of metabolic syndrome among corporate executives in Gauteng Province in were they found males having higher BMI values (45.2% in overweight and 22.2% in obesity) than females (32.6%) in overweight and 16.9%). However, several (Shayo et al., 2011; Mogre, Aleyira and Nyab, 2014; Shukla, Kumar and Singh, 2014 and Letamo, 2011) studies contradict with this findings in their studies, they find females having higher prevalence of overweight and obesity than males. The prevalence of underweight was found to be higher in females (83.3%) than in males (16.7%), these results were supported by a study done by Nwachukwu, Nwagha, Obikile, Ejezie, Okuosa, Nweke and Ezeh (2010) on Assessment of body mass index and blood pressure among University students in Nigeria.

5.3 Factors associated with obesity

5.3.1Socio-demographic factors and BMI

The prevalence of obesity was noticed in all age groups, however it was more dominant within the age group of 45-54. The prevalence of underweight was only found within age group 18-24 and 25-34. A study conducted by Sen, Mondal and Dutta (2013), on factors affecting overweight and obesity among urban adults showed high obesity levels to those individuals belonging to middle ages (31-45) and higher ages (46-50) than those in lower ages (≤30). In this study overweight and obesity was higher on married participants than in single participants and in underweight prevalence, single participants have the higher prevalence than married participants. The findings were supported by Wilson (2012), where he found out that married participants have an increase in weight gain than unmarried participants. In the researcher's view this can be due to the fact that when one is married as a woman you give birth which can increase the body weight and in males as the head of the family you have so many responsibilities which end up inviting stress and stress is associated with weight gain.

The results of the study found the prevalence of overweight and obesity to be high in participants with secondary and primary educational levels. Participants with none education were having less prevalence of obesity as well as those with tertiary educational level, the results contrary with that of McLaren (2007) which reported that obesity is associated with education attainment and is higher in women and men with fewer education. Employed participants were having higher prevalence of overweight and obesity than unemployed participants. Participants with an income of less than R5000 have predominant prevalence of obesity than those earning R5000-R10000 and more than 10000. The results showed significant different between BMI and age, marital status, educational status, employment status and household income, the findings were similar with that of Sen, Mondal and Dutta (2013).

5.3.2 Lifestyle factors and BMI

The study reveals that only 22% of the participants engage in physical activity and 75.2% of the participants who are obese was of those who do not engage in physical activity and 24.8% of obese participants are those who are physical active. The results support the statement of Micklesfield et al. (2014) that says South Africa appears to be a relatively inactive nation. Shayo et al., (2011) found in their study found the prevalence of obesity to be high in participants who do light intensity activities followed by those who do moderate intensity activities while those who did vigorous activities were having less prevalence of obesity.

When comparing the results of this study which only asked if participants are physical active or not with the results of Shayo et al., (2011) which went in detail on asking participants if they do low, moderate or vigorous activity they concur with what was stated by Skaal (2011) when he stated that more than half of adults are not regularly physical active at recommended levels and about 60% of the global population fail to meet the recommendation of 30 minutes of moderate intensity daily including those who are already physical active. There was no statistically significant different in BMI and physical active among participants as overweight and obesity was found among participants who engage in physical activity and those who do not. The statistical results were compatible with the findings of Labiee, Van de Mhead, Rutten, Rodenburg, Koopmans and Foets (2015) which revealed that physical active was not associated with BMI and the prevalence of overweight and obesity among the study sample.

In this study majority of the participants (63.5%) take meals 3 times a day and they are more likely to be obese, 19.2% of the participants do not skip breakfast, only 14.5% of the participants skips breakfast and 16.8% of the obese participants never skips breakfast. The results showed negative association between frequency of meals per day and breakfast. The results were consistent with the results of Yunsheng, Bertone, Stanek, Reed, Herbert, Merriam and Ockene (2003) which showed association between eating patterns and obesity. However Thompson-Mc Comick, Thomas, Bainivualiku, Khan and Becker (2010) found skipping of breakfast and meals to be associated with overweight and obesity. The study reveals that most of the participants (23%) take fruits 2-4 days a week, 20.4% take fruits 5-6 days a week and 17% take fruits daily. In vegetable intake, majority of the participants take vegetables 2-3 times per month (30.8%), less than 2 times per month (24.2%) and 20.1% never take vegetables.

Snacks consumption has increased significantly in recent years and given that snacks foods are high in fat and sugar, this has implications for weight gain and obesity (Cleobury and Tapper,

2014). The current results of this study found majority of the participants takes snacks (26.4%) and sweets (31.3%) 2-4 days a week and once a week (24.2%; 28.6%). The prevalence of overweight and obesity was noticed in all frequencies, however it was high in those who take snacks once a week and those who takes sweets 2-4 days a week. Majority of the participants (57.5%) never take low fat dairy products and 60.2% of obese participants never take low fat dairy products. In whole grains intake, 70.4% of the participants never take whole grains and 76;1% of the obese participants never take whole grains. Intake of fried food and fast food was noticed in all frequencies per week, however highest prevalence of obesity (11.3%) was found in those who eat fried food 2-4 days a week and in fast food intake, highest prevalence (13.2%) was found in those who eat fast food 2-3 times per month. The results showed negative significant different between BMI and lifestyle factors, the results contradict with the results of Al-Hazzaa, Abahussain, Al-Sobayel, Qahwaji and Musalger (2012) which revealed association between BMI and lifestyle factors.

5.3.3 Sedentary Behaviour and BMI

The study results found majority of the participants spending their time watching or playing video games for 3 hours (15.7%), 4 hours (33%) and 26.1% spending 5 or more hours. The highest prevalence of obesity (34.5%) was found in those who spent 4 hours on watching TV or playing video games. Giles-Corti et al., (2003) they reported sedentary pursuits such as TV viewing to be strongly associated with both overweight and obesity, particularly if television is watched for 3 or more hours per day.In physical activity, 78% of the participants were physical inactive. Only 15.4% of the participants use their foot as a source of transport to their destinations (work/school/town) and the prevalence of obesity was higher in participants who use bus/taxi (53.1%) and those who use car (30.1%) to work/school/town. the results showed significant different between mode of transport and BMI.

Majority of the participants travel <3km (46.2%) and 5km (47.5%) to work/school/town and the prevalence of obesity was found to be high in this participants who travel <3km (54%) and 5km (43.3%). The time taken by majority of the participants was 5-15 minutes (67%) and <5 minutes (22%), obesity prevalence was found to be high in those who take 5-15 minutes (77%) and <5 minutes (18.6%). 30.2% of the participants eat while watching TV, obesity prevalence was found to be in both participants who eat while watching TV and those who do not. There was no significant difference between screening time, distance, time, eating while watching TV and obesity.

5.3.4 Neighborhoods Environmental factors and BMI

In Environmental factors, participants who had access to commercial places were 26.4% and 69.5% did not have access to commercial places. The prevalence of obesity was high (65.5%) on participants who had no access to commercial places. In access to residential places, the finding of this study reveals the prevalence of obesity to be high (88.5%) on participants with no access to non-residential places and no presence of recreational facilities (99.1%), it is possible that the prevalence is high because participants are physical inactive as majority of the participants do not have access to places where they can jog or take a walk while in access to public transport majority of the participants who are obese have access to public transport. It is said that sedentary lifestyle includes those who depends more on motor vehicle and public transport with a decrease in cycling and walking (Giles-Corti et al., 2003). In participants who perceived no presence of pedestrian pathways and seeing people active were more likely to be obese.

In participants who perceive connective of streets majority have the higher prevalence of obesity. In traffic safety for bicycle, participants who perceive no traffic safety were more likely to be obese while in those participants who perceive traffic safety in walking, the prevalence of obesity was noticed in both sides (to those who perceive and those who do not). Most participants (86.2%) have no access to fruits and vegetables and the prevalence of overweight and obesity was high in those participants with no access to fruits and vegetables. Participants perceive crime safety during the day while at night there is no crime safety. Obesity was more likely to be on participants who do not perceive crime safety at night. There was negative significant different between environmental factors and BMI. Giles-Corti et al., (2003) in their study they found association between environmental factors (streets with sidewalks, perceiving no paths within walking distance, poor access to recreational facilities, no shop within walking distance) were associated with obesity while access to motor vehicle was negatively associated with obesity.

5.3.5 Psychological factors and BMI

Food is often used as a coping mechanism by those with weight problems especially when they are sad, anxious, stressed, lonely and frustrated. In most individuals who are obese there is a repeatable cycle of mood disturbance, overeating and weight gain. When they feel distressed they turn to food to help them cope (Collins and Bentz, 2009). The current results of this study shows 32.4% of the participant sometimes eat when they are worried, 54.4% never eat when

they are worried and 13.2% always eat when they are worried. Participants who never eat when they are worried and those who sometimes eat when they are worried were more likely to be overweight and obese. Half of the participants never eat when they are angry, 32.1% sometimes eat when they are angry and 13.2% always eat when they are angry. Obesity prevalence was more in participants who never eat when they are angry.

In participants who treat themselves with food after doing something well, 47.2% always eat when they did something well, 37.7% sometimes eat when they did something well and 15.1% never treat themselves with food when they did something well. Most participants (40.9%) were found to be eating sometimes when they are happy, 36.8% never eat when they are happy and 22.3% always eat when they are happy. The prevalence of obesity was found to be high in participants who never eat and sometimes eat when they are happy. In participants who eat when they are bored, 41.5% never eat when they are bored, 37.7% sometimes eat when they are bored and 20.4% always eat when they are bored. The prevalence of overweight and obesity was more noticed in participants who never eat when they are bored and those who sometimes eat when they are bored

The results of the study shows 39.6% of the participants never eat when they are stressed, 38.7% sometimes eat when they are stressed and 21.7% always eat when they are stressed. The prevalence of obesity was noticed in all classes of eating when participants are stressed. In participants who feel lonely, 35.8% never eat when they are feeling lonely, 42.5% sometimes eat when they are feeling lonely and 21.7% always eat when they are feeling lonely. The prevalence of obesity was also noticed in all classes of participants who eat when feeling lonely. The findings showed negative significant effect between BMI and psychological factors, however eating when worried showed a positive significant effect.

5.3.6 Family History and BMI

The results of the study found 37.4% of the participants having close blood relatives with obesity and 62.6% of the participants did not have relatives who are obese. The prevalence of obesity was more likely to be on participants with close blood obesity relatives. There was significant different between BMI and family history.

5.4 Consequences of obesity

5.4.1 Association between BMI and Blood pressure level

The findings of this study reveals that 61% of the participants have normal blood pressure, 28.9% wre pre-hypertensive and 10.1% were hypertensive. The prevalence of overweight and obesity was more likely to be on participants with normal blood pressure and those who are pre-hypertensive. There was a positive significant effect between obesity and blood pressure levels. A similar study conducted by Dulskiene, Kuciene, Medzioniene and Benetis (2014) found 12.8% of the participants to be pre-hypertensive, 22.2% to be hypertensive and 65% to be normotensive, they also found overweight and obesity to be associated with pre-hypertensive and hypertension. Shukla et al. (2014) concurs with the findings of this study wherein they found that overweight and obesity to be positively associated with hypertension in South Africa.

5.4.2 Association between BMI and Glucose levels

Three and half million of South Africa which is 6% of South Africa population suffer from diabetes and more of South Africans are undiagnosed, five million of South Africans have pre-diabetes (
Papotsakis, Yannakoulia, Ntalla and Dedousis, 2012). In the current study 90.3% of the participants have normal glucose, 7.8% are at high risk and 1.9% are at very high risk of developing diabetes. The prevalence of overweight and obesity was more likely to be in participants with normal glucose levels. The statistically results showed a positive significant between glucose levels and BMI. The results concurs with the results of Resnick, Valsania and Halter (2000) which revealed a close association between BMI and risk of developing type 2 diabetes, the relative increased with BMI. It also concurs with the statement that was stated by Steyn (2007) when he said the risk of developing Type 2 diabetes increases in people with overweight and obesity.

5.4.3 Association between BMI and cholesterol levels.

High levels off blood cholesterol are associated with an increased risk of mortality from coronary heart disease for adults (Muluvhu et al., 2014). The results of this study reveals majority of the participants (74.2%) to be having normal cholesterol levels, 20.4% had cholesterol levels at borderline and 5.5% had cholesterol levels which were at high risk. The results shows no statistical significant between cholesterol levels and BMI, these results contrary with the general consensus that total cholesterol rises with body mass index (Gostynski, Gutzwiller, Kuulasmaa, Doring, Ferrario, Grafnetter and Pajak, 2004).

5.5 The Impact of Obesity

Obesity is a serious health problem causing more than 1 million deaths and 12 million life years of illness each year. It is associated with increased medical costs, premature death, less healthy lifestyle choices, psychological problems as well as poor quality of life (Burkert, Rasky, Grobschadi, Muckenhuber,and Freid, 2013). In 1991 the cost of cardiovascular diseases was between R4 135 and 5035 billion which did not include the costs of rehabilitation and follow up (Steyn, 2007). South Africa is already losing more people in the work force age group of 35-64 years because of cardiovascular diseases which are mostly caused by obesity compared to other countries. Estimates were that, the cost of cardiovascular disability payments in South Africa equals to US$ 70 million (Leader,Greenburg, Liu and Esson, 2004). This was in 2000 surely the amounts have increased since 2000.

Overweight and obesity are major risk factors for developing hypertension, diabetes and heart disease. WHO (2005) reported annual losses in national income from heart disease, stroke and diabetes to be estimated at $18 million in China, $ 11 billion in Russia, $9 million in India and $ 3 million in Brazil. China was expected to lose $558 billion over 10 years in foregone national income due to heart disease, stroke and diabetes alone. India and Russia were expected to lose $200 billion and $ 300 billion in the same period.

CHAPTER 6

6.1 Introduction

Conclusion was formed from the findings of the study within the framework of the objectives of the study and recommendation were mentioned based on the findings of the study.

6.2 Conclusion

The findings of this study found the prevalence of obesity (35.5%) and overweight (28.6%) to be high among residents of Tshikota Location. Males showed higher prevalence of obesity (51.3%) than females (46.7%), they also showed high prevalence in overweight (57.1%) compared to that of females (42.9%). Factors contributing to obesity were found to be diverse, they include socio- demographic, lifestyle, behavioral, environment, psychological and family history.

Obesity was found to be more dominant within the age group of 45-54. Participants with secondary and primary educational levels were having high prevalence of overweight and obesity whereas participants with none education and tertiary level were having less prevalence of obesity. Employed participants were having higher prevalence of overweight and obesity than unemployed participants. Participants with an income of less than R5000 have predominant prevalence of obesity than those earning R5000-R10000 and more than 10000. In socio-demographic variables, age, marital status, educational status, employment status and income were found to be the important factors contributing to obesity.

Only 22% of the participants engage in physical activity and 75.2% of the participants who are obese were of those who do not engage in physical activity. Majority of the participants take meals 3 times a day and they are more likely to be obese and 19.2% of the participants do not skip breakfast. Most of the participants (23%) were found taking fruits 2-4 days a week, 20.4% take fruits 5-6 days a week and 17% take fruits daily. In vegetable TRintake, majority of the participants take vegetables 2-3 times per month (30.8%), less than 2 times per month (24.2%) and 20.1% never take vegetables. In snack intake majority of the participants takes snacks (26.4%) and in sweets (31.3%) 2-4 days a week and once a week (24.2%; 28.6%). Majority of the participants (57.5%) never take low fat dairy products and 60.2% of obese participants never take low fat dairy products. In whole grains intake, 70.4% of the participants never take whole grains and 76.1% of the obese participants never take whole grains. Intake of fried food and fast food was noticed in all frequencies per week. The results showed negative significant different between BMI and all lifestyle variables.

Most of the participants were found spending their time watching or playing video games for 3 hours (15.7%), 4 hours (33%) and 26.1% spending 5 or more hours. . Only 15.4% of the participants use their foot as a source of transport to their destinations (work/school/town). Majority of the participants travel short distance to their destination yet they prefer to use vehicles which increases the risk of developing obesity. In sedentary behavior factors, only mode of transport was found to be an important factor associated with obesity.

In neighborhoods environmental variables, the prevalence of obesity was found to be higher to participants who do not have access to commercial places, non-residential places, recreational facilities, fruits and vegetables and those who do not perceive traffic safety for bicycle, pedestrian pathway, seeing people active and crime safety at night. Most participants have access to public transport and majority of them were obese. In psychological variables the important risk factor was noticed on people who eat when they are worried. Family history was also found to be an important contributing factor to obesity

The study assessed blood pressure, glucose levels and cholesterol levels to examine the health consequences of obesity. 28.9% of the participants were pre-hypertensive and 10.1% were hypertensive and obesity was found to participants with normal blood pressure and those who are pre-hypertensive. 7.8% of the participants were found to be at high risk and 1.9% were at very high risk of developing diabetes and 5.5% had cholesterol levels which were at high risk. Blood pressure and glucose levels were found to be significant health consequences of obesity in this study.

6.3 Recommendations

The study showed a high prevalence of obesity, this study recommend an obesity awareness campaign to minimize the high prevalence of obesity in the community. The findings also showed majority of participants not having access to fruits and vegetables, improving availability of supermarkets and full service grocery stores might help the participants to have selection of healthy food such as fruits and vegetables. The community must build recreational facilities such as parks, sports fields, public pools and community playgrounds for community members to engage in physical activities and also the community requires interventions that will encourage physical activity and reduce sedentary behavior in the community. Traffic safety must be enhanced by creating textured pavement to increase safe places to walk, run and bicycle so as to encourage physically activity.

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APPENDIX 1: PROPOSED TIME LINE FOR RESEARCH PROJECT

ACTIVITIES	TIME FRAME														
	2015	2016												2017	
	Aug – Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Preparing for proposal															
Proposal presentation to DPH															
Corrections from DPH Presentation															
Proposal presentation to SHDC															
Language editing before submission to UHDC															
Obtaining ethical clearance															
Obtaining permission from Councilor at															

Tshikota Location															
Pre-test															
Data collection															
Data entry and analysis															
Writing a report															
Submission of first draft															
Submission of second draft															
Submission of final draft															

APPENDIX 2: BUDGET

3.11 Budget

Item	Description	Quantity	Unit price	Total cost (R)
PRINTING & BINDING	Printing of Questionnaires	1920 pages	R2X6 pages X 320 Copies	R3840
	Spiral binding	5 copies	R100/copy X5	R500
	Final binding	5 Copies	R300/copy X5	R1500
Subtotal				**R5840**
SALARIES	Language Editor	1	R3500	R3500
	Data collection	1 Assistants	R280/day for 5	R1400

			days	
	Data analysis	1	R3000	R3000
Subtotal				**R7900**
EQUIPMENTS & STATIONERY	Glucose & Cholesterol stripes	13	25's @ R768	R9984
	Lancets	4	100's @ R205	R820
	Alcohol swaps	2	200's @ R50	R100
	Gloves	4	100's @ R79	R316
	USB	1	R90	R90
Sub-total				**R11 310**
TRAVELLING EXPENSES	From Univen to Tshikota location. To and From for 3 days	150km@R3.30 /km	R495/day for 5 days x 2 people	R4950
	Sub-total			**R4950**
Grand total				**R30 000**

APPENDIX 3: RESEARCH QUESTIONNAIRE AND MEASUREMENT INSTRUMENT A QUESTIONNAIRE ASSESSING THE RISK FACTORS ASSOCIATED WITH, AND CONSEQUENCES OF OBESITY AMONG RESIDENTS OF TSHIKOTA LOCATION IN MAKHADO MUNICIPALITY, LIMPOPO PROVINCE, SOUTH AFRICA.

Section A: Socio-demographic information

1. Age: …….

Make a tick on the appropriate response

2. Gender

Female	Male

3. Marital status

Single	Married	Divorced	Widowed

4. Religion

Christian	Muslin	Catholic	African Tradition

5. Educational status

Tertiary	Secondary	Primary	None

6. Employment Status

Employed		**Unemployed**	
Government Private Self employed		Homemaker Student Retired Unable to work	

7. Income

< R1000	R2000-R5000	R5 000-R10000	>10000

Section B: Lifestyle Factors

Physical activity

8. Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying or lifting heavy loads, digging or construction work] for at least 10 minutes continuously? Yes/ No …….. If No go to Q11.

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

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

11. Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads] for at least 10 minutes continuously? Yes/No……. If No go to 14.

12. In a typical week, on how many days do you do moderate intensity activities as part of your work? .....

13. How much time do you spend doing moderate-intensity activities at work on a typical day? .....

14. Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places? Yes/No……..If No go to Q17.

15. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?.....

16. How much time do you spend walking or bicycling for travel on a typical day? .....

17. Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football] for at least 10 minutes continuously? Yes/No……If No go to Q20.

18. In a typical week, on how many days do you do vigorous intensity sports, fitness or recreational (leisure) activities? …….....

19. How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day? ……

20. Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that cause a small increase in breathing or heart rate such as brisk walking, [cycling, swimming and volleyball] for at least 10 minutes continuously? Yes/No…….

21. In a typical week, on how many days do you do moderate intensity sports, fitness or recreational (leisure) activities? …….

22. How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day? ……

Nutrition

23. How many times do you usually eat the following? (Please mark only one box for each line)

	Never	Daily	Once a week	2-4 days a week	5-6 days a week	2-3 times per month	Less than 2 times per month
Fruits							

Vegetables							
Sweets (candy/chocolate)							
Regular cola or soft drinks that contain sugar							
Cake, pastries, or donuts							
Potato chips or peanuts							
French fries							
Dark green vegetables (broccoli, spinach, etc.)							
Orange vegetables (carrots, squash, sweet potato, etc.)							
Fruit juice							
Low fat milk (1%,2%, skim)							
Whole milk (homogenized)							
Cheese							
Other milk products (yogurt, chocolate milk, pudding, etc.)							
Whole grain bread or cereal (oatmeal, muesli, etc.)							
Energy drinks (Red Bull, Rock Star, Guru, etc.)							
Sports drinks (Gatorade, Powerade, etc.)							
Fish							
Fried food such as chicken wings, chicken fingers, french fries, etc							
Cookies, biscuits, chocolate or candy bars							

Ice cream							
Fast foods such as pizza, hamburgers, etc							

24. How often do you usually have **breakfast?** Mark where it's appropriate for weekdays and for weekend.

- I never have breakfast on weekdays
- One day
- Two days
- Three days
- Four days
- Five days
- I never have breakfast on the weekend
- usually have breakfast on only one day of the weekend (Saturday OR Sunday)
- I usually have breakfast on both weekend (Saturday AND Sunday)

25. During the past week**,** how many meals (breakfast, lunch or dinner) did you get that were **prepared away from home** in places such as restaurants, fast food places, food stands, grocery stores or vending machines? ……..

Sedentary behaviour

26. How many hours do you spend watching TV, during the week?

- I do not watch TV
- < 1 hour
- 1 hour
- 2 hours
- 3 hours
- 4 hours
- 5 or more hours

27. How many hours do you play video or computer games or surf the internet during the week?

- I do not play video or computer game or do internet surfing
- < 1 hour
- 1 hour
- 2 hours

- 3 hours
- 4 hours
- 5 or more hours

28. How much time do you spend outside during the week?
    - < 1 hour
    - 1 hour
    - 2 hours
    - 3 hours
    - 4 hours
    - 5 or more hours

29. How many hours do you spend watching TV on weekends?
    - I do not watch TV on weekends
    - < 1 hour
    - 1 hour
    - 2 hours
    - 3 hours
    - 4 hours
    - 5 or more hours

30. How many hours do you play video or computer games or surfing internet on weekends?
    - I do not play video or computer game or internet surfing
    - < 1 hour
    - 1 hour
    - 2 hours
    - 3 hours
    - 4 hours
    - 5 or more hours

31. How many days do you involve yourself in physical activities?
    - 0 days
    - 1 day
    - 2 days
    - 3 days
    - 4 days
    - 5 days

32. The **MAIN** part of your journey to school, work or town was by/on

- foot
- bicycle, roller-blade, skateboard or scooter
- bus or taxi
- car
- other

33. What is the distance from home to school, work or town?
    - < 3km
    - 5 km
    - 10km
    - > 10km

34. How long does it take you to travel to school, work or town?
    - < 5 minutes
    - 5 - 15 minutes
    - 16 - 30 minutes
    - 31 minutes to 1 hour
    - >1 hour

35. How many times do you eat the following food items **while watching television**?

	Never	Daily	Once a week	2-4 days a week	5-6 days a week	2-3 times per month	Less than 2 times per month
Potato chips or peanuts							
Fried food such as chicken wings, chicken fingers, french fries, etc							
Cookies, biscuits, chocolate or candy bars							
Ice cream							

Fast foods such as pizza, hamburgers, etc							
Fruits or vegetables							

Section C:Neighborhoods Environmental factors

Complete the statements by **ticking** on Yes or No

Q no.	Statement	Yes	No
36	Access to commercial places		
37	Access to non-residential Places		
38	Access to public transport		
39	Presence of recreational facilities		
40	Presence of pedestrian Pathways		
41	Seeing people active		
42	Connectivity of streets		
43	Traffic safety for bicycling		
44	Traffic safety for walking		
45	Access to fruits and vegetables		
46	Crime Safety during the day		
47	Crime safety at night		

Section: D Psychological factors

How well do these statements describe you? (Put a mark in the box that best describes how often this happens).

Q No	Statement	Never	Sometimes	Always
48	When I am worried I eat too much			
49	I eat when I am angry			
50	When I do something well I give myself a food treat			
51	When I am sad I eat more			
52	When I am happy I eat more			
53	When I am bored I eat more			
54	I eat a lot when I am stressed			
55	When am feeling lonely, I eat more			
56	Depression makes me eat more			

Section: E Family History

Family History

57. Indicate by a **tick** if you have a relative with obesity condition on the below table.

	Overweight	Obese	Extremely Obese
Father			
Mother			
Brother			
Sister			
Paternal grandfather			
Paternal grandmother			
Maternal grandfather			
Maternal grandmother			

DATA COLLECTION FORM

		Trial 1	Trial 2	Trial 3
	Anthropometric measurements			
1	Weight (kg)			
2	Height (m)			
3	**BMI**			
	Clinical measurements			
	Blood Pressure: Systolic Blood pressure Diastolic Blood pressure			
	Glucose level			
	Cholesterol level			

APPENDIX 4: REQUEST TO CONDUCT RESEARCH

University Of Venda
Private Bag X5050
Thohoyandou 0950
December 2016

The Councillor of Tshikota Location
Tshikota
Makhado
0920

Dear Sir/Madam

RE: Request for permission to conduct a research on residence of tshikota location.

I am a master's student at the University of Venda. In order to complete my degree (Master of Public Health) I am expected to conduct a research project of my choice in any place.

I have chosen to conduct a study at Tshikota Location as a resident of this place. The purpose of the research project is to assess the risk factors associated with, and the consequences of obesity among Tshikota residents, as it was observed that the level of obesity in Tshikota is high, therefore I want to assess the causes of obesity among residence.

A questionnaire and measurement instrument will be used for data collection. The information gathered will be treated with uttermost confidentiality. Participants will have the full right to refuse to participate in the research and those that do not wish to participate further in the study can withdraw at any time. A summary report will be made available to the residence councillor after the study.

I will appreciate if my request will be granted.

Yours faithfully

Ndou Rembuluwani.M

ndourembuluwani5@gmail.com

0768799786

APPENDIX 5: CONSENT FORM

1. Purpose and explanation of the assessment

The purpose of the study is to assess the factors associated with excessive weight and obesity and the related health risks. A self-administered questionnaire will be provided in English, and the Tshivenda language will be used for translation for participants that do not understand the English language. The questionnaire is comprised of five sections, socio-demography, behavioral lifestyle, environmental, socioeconomics, psychological and genetics factors.Automatic sphygmomanometer will be used to measure blood pressure, cardio-check machine will be used to measure glucose and cholesterol levels, digital weighing scale and stadiometer will be used to measure weight and height.

2. Benefits to be expected

The results obtained in the study will help the residents to become aware of their BMI, amount of fat and whether they are underweight, normal, overweight and obese. It will also help participants to find out their health status of blood pressure, cholesterol levels and glucose levels.

3. Inquiries

Any question about the procedures that will be used in the assessment or about the results of the assessment are encouraged. If you have any concern or question, please ask for an explanation.

4. Ethical Considerations

The information obtained during assessment will be treated as privileged and confidential, as described in the Health Insurance Portability and Accountability act of 1996. It is not to be released or revealed to any person without your written consent. The information obtained will be used for statistical analysis or scientific purposes with your right of privacy attained.

5. Freedom of consent

By signing this form I indicate that I read and understand the above information and I hereby consent that I will voluntary participate in this study as one of the participant.

Signature of participant…..... Date……..……

Signature of the researcher…….. Date……..