WEIGHT, CHRONIC DISEASE RISK AND PHYSICAL ACTIVITY LEVELS OF RURAL AND URBAN WOMEN IN ZIMBABWE

BY

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ABSTRACT

Introduction:

In developing countries there is a shift from traditional diets and lifestyles to western diets and lifestyles particularly in rapidly growing urban populations. This is a major cause of overweight and obesity. Obesity is a well-recognised risk factor for various chronic diseases. Chronic diseases are the largest cause of death in the world. They include cardiovascular disease, some cancers, chronic lung diseases and raised blood pressure. Maintaining a physically active lifestyle by doing regular moderate physical activities helps to keep a healthy weight and lower the risks of chronic diseases.

Aims:

The aim of this study was to compare weight, chronic risk diseases and physical activity levels of rural and urban women in selected Zimbabwean communities.

Methods:

A cross sectional descriptive and comparative design was followed in the study. The study population included all black Zimbabwean women aged 18 to 60 years residing in Bulawayo Metropolitan Province (Urban) and Matabeleland North Province (Rural). A sample size of 280 women participated in this study. One hundred and forty were urban residents from high density suburbs and 140 were rural residents. Anthropometric variables (mass, stature, waist and hip circumferences) were measured. Three questionnaires were administered; International Physical Activity Questionnaires (IPAQ), Quality of Life, and Nutritional questionnaires. Descriptive statistics including means and standard deviations were used. The Chi-square goodness-of-fit-test, a univariate test was used for categorical variables to test response options and the independent t-tests and Chi-square test of independence were used to compare group cases and the significance was set at $p \leq 0.05$. The SPSS version 22 statistical package was used to conduct data analysis.

Results:

The average weight for urban women 71.19±15.23kg was significantly higher than that for rural women 66.58±13.74kg, t (278) = -2.657, p=0.008. When considering Body Mass Index (BMI) classification, a significant number were either normal (117) or overweight (96), χ^2 (4) =181.500, $p<0.0005$. There was a significant difference between rural and urban women in terms of BMI ($p = 0.009$). There was a significant relationship between age and BMI ($p < 0.05$). Older women 30 years and above were classified as overweight and obese compared to the younger women. There

was a significant difference between urban and rural women 0.80± 0.60 and 0.78± 0.68), t (278) = -2.055, p= 0.003 in terms of waist to hip ratio (WHR). On chronic disease risk the urban women were at high and very high risk, while rural women were not at risk ($\chi 2$ (4) = 11.762, p=0.019). There was no significant difference in blood glucose levels between urban and rural women. A significant difference was shown across age groups of blood glucose levels (Welch (3, 51.868) = 3.205, p=0.031). A significant difference across age groups of cholesterol was noted; levels (F (3, 133) = 7.123, p < 0.0005).

There was a significant relationship between location and blood pressure p=0.025, with rural women having a higher raised blood pressure than urban women. Both rural women and urban women were physically active and a significant difference was noted in the transport domain, t (278), 2.002, p=0.46. There was no significant difference in quality of life between rural and urban women. There was a significant difference between energy consumption and location, t (278) = -5.202, p<0.0005. Urban women had significantly high protein consumption p=0.007, and fat consumption p<0.0005.

Conclusion:

The study findings highlight a higher prevalence of overweight and obesity in urban women compared to rural women in terms of BMI and waist to hip ratio. The Zimbabwean women show an increased risk for chronic health problems with higher prevalence in urban women than rural women especially raised blood pressure. There was a low prevalence of raised blood glucose in both the groups. Raised blood cholesterol prevalence was higher in urban than rural women. Both rural and urban women had good quality of life scores. Urban women had high consumption of macronutrients than rural women. Both urban and rural women showed high levels of physical activity.

Key words

weight, overweight, obesity, chronic diseases, physical activity, women

DECLARATION

I, Sinikiwe Mhlanga declare that

1. The research reported in this thesis, except where otherwise indicated is my original research.

2. This thesis has not been submitted for any degree or examination at any other university.

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LIST OF ABBREVIATIONS

BMI	Body Mass Index
WHR	Waist to Hip Ratio
PA	Physical Activity
IPAQ	International Physical Activity Questionnaire
QoL	Quality of Life
CVDs	Cardio-vascular Diseases
WHO	World Health Organisation
IASO	International Association for the Study of Obesity
LDL	Low Density Lipoprotein
HDL	High Density Lipoprotein
ISAA	International Standards for Anthropometric Assessment
AU	African Union
IDF	International Raised blood glucose Federation
mmol/l	Millimoles per litre
mmol/d/L	Millimoles per decilitre
mmHg	Millimetres of mercury
SSA	Sub Saharan Africa
MET	Metabolic
min	Minutes
kg	Kilograms
cm	Centimetres
kg/m^2	Kilograms per square meter

CHAPTER ONE: INTRODUCTION

1.1 Background

It was not until the 20th century that the World Health Organisation (WHO) finally recognised obesity as a global epidemic. In 2014, more than 1.9 billion adults, 18 years and older were overweight and 600 million were obese. Of these 38% of men and 40% of women were overweight, while 11% of men and 15% of women were obese (WHO, (2014). The problem of obesity is increasing in the developing world with more than 115 billion people suffering from related problems. Adediran et al. (2012), reported that the prevalence of obesity is increasing rapidly in both developed and developing nations and it has reached epidemic proportions globally. The evidence suggests that the situation is likely to get worse.

Overweight and obesity are well understood to be a result of an energy imbalance (Benkeser et al., 2012). Obesity is a problem affecting people of all ages, ethnic backgrounds and socioeconomic status. Many people in developed and developing countries are dying from obesity associated diseases (Lozano et al., 2013). However, many people are still under the impression that overweight and obesity affects the Western world and that lower resource countries continue to struggle with only underweight, malnutrition and infections (Akarolo-Anthony et al., 2014). This may not be the case as the WHO estimated that the prevalence of overweight and obesity in 2010 was as high as 63.8% and 21.3%respectively for men, and 73.8% and 43.2% respectively for women in some Sub-Saharan African (SSA) countries (Leiba et al., 2013). Obesity is a recognised risk factor for various chronic health problems such as cardiovascular diseases (CVDs), high blood pressure, stroke, raised blood glucose, osteoarthritis and certain cancers (Asfaw, 2006).

Chronic disease can be defined as illness that are prolonged, do not resolve spontaneously and are rarely cured (Control and Prevention, 2008). Currently chronic diseases represent 43% of the global burden of disease, which indicates an emerging epidemic as deaths as a result of chronic diseases are predicted to rise between 60% and 70% of all deaths in 2020 (Abegunde et al., 2007). According to Kengene and Mayosi (2012), the common chronic diseases are heart disease, stroke, cancer, chronic respiratory diseases, diabetes, mental disorders, vision and hearing impairment, oral disease, bone and joint disorders and genetic disorders. These diseases are also referred to as chronic illness, non-communicable diseases and degenerative diseases. The World Health Organisation (2005), say chronic disease epidemics cause are well established and known, the most important modifiable risk factors of chronic diseases include unhealthy diet and excessive

energy intake, physical inactivity and tobacco use. These causes are expressed through the intermediate risk factors of raised blood pressure, raised blood glucose levels, abnormal blood lipids and overweight and obesity (Kengene and Mayosi, 2012). While individuals understand that risk factors contribute to chronic diseases, market research indicates they aren't moved to take preventive measures, as most don't consider themselves at risk until they are older (Neeland et al., 2012). It is vitally important that the impending chronic disease pandemic is recognised, understood and acted upon urgently. These diseases are predicted that in the foreseeable future they will take the greatest toll in deaths and disability particularly in the developing countries (Organization, 2005).

Many developing countries have been regarded as countries in transition experiencing a shift in disease type and prevalence, closely linked to rapid urbanisation, economic growth and technological advances (Alba et al., 2010). The shift in disease burden has been largely attributed to the ongoing nutrition transition and lifestyle changes characterised by changes in food supply and intake and reduced physical activity at the workplace and leisure (Popkin, 2006).

Ongoing global shifts in diet towards consumption of high-fat and high sugar foods, coupled with urbanisation and an increasingly sedentary lifestyle for many populations, are generating an upwards shift in BMI (Cresswell et al., 2012). Rates of overweight and obesity are high in Africa particularly among women, and are a cause of concern (Peer et al., 2014). Zimbabwe, a low-income country in the SSA is not spared from the global epidemic as most parts of the country are still plagued with malnutrition but changing social and lifestyle factors have created overweight and obesity to become much more prevalent, especially in women in urban centres (WHO, (2014).

According to Doku et al. (2012), urban women gain much weight as they engage in less physical activity than rural women who are mostly engaged in agricultural and other physical activities on a daily basis. Physical activity is of vital importance for the prevention and treatment of a number of chronic conditions, ranging from depression, obesity and poor health in general. In the chronic diseases literature and in most public health campaigns in middle-and upper-income countries, physical activity is virtually synonymous with voluntary, leisure-time exercise undertaken to induce cardio-respiratory fitness (Bauman et al., 2012).

Physical inactivity has been identified as the forth risk factor for mortality with 6% of deaths globally. This follows high blood pressure with 13%, tobacco use with 9% and high blood glucose with 6%, overweight and obesity are responsible for five of global mortality (Goryakin et al., 2015). Physical inactivity is estimated to be the main root of breast cancer and colon cancer

burden for approximately 21% to 25%, 27% of raised blood glucose and approximately 30% of ischemic heart disease burden (WHO,(2011). Physical inactivity among children and adults seems to persist and this makes physical inactivity among young people a high risk factor for cardiovascular diseases, cancer and osteoporosis in adults (Hardman and Stensel, 2009).

It has been estimated that physical inactivity levels could be reduced by 31% through improved environmental interventions, including pedestrian and bicycle friendly urban land use and transport, leisure and workplace facilities, and policies that support more active lifestyle (WHO, (2012).

The levels of obesity and overweight have been shown to be increasing in low income countries especially among women. There is very limited data on overweight and obesity, insufficient physical activity and chronic disease risk levels, making it difficult to make informed public health decisions by the Zimbabwean government for it to craft policy and appropriate interventions. The aim of this study was to compare overweight and obesity, chronic disease risk and physical activity levels among urban and rural women in communities in Zimbabwe.

1.2 Aim of the Study

The aim of the study was to compare weight, chronic disease risk and physical activity levels among the urban and rural women in communities in Zimbabwe between the ages of 18-60 years.

1.3 Objectives

1. To compare the weight levels of urban and rural women in Zimbabwe.
2. To compare chronic disease risk levels among urban and rural women in Zimbabwe.
3. To compare physical activity levels among urban and rural women in Zimbabwe.

1.4 Hypothesis

1. It was hypothesized that there is a difference in weight of women in urban and rural Zimbabwe.
2. It was hypothesized that there is a difference in chronic disease risk in urban and rural women in Zimbabwe.
3. It was hypothesized that there is a difference in physical activity levels of women in urban and rural Zimbabwe.

The outline of this thesis is as follows:

Chapter Two provides a review of related literature regarding overweight and obesity, chronic diseases, physical activity and obesity and beliefs about obesity.

Chapter Three is the original research manuscript (this is the accepted format for the submission of the Masters dissertation in the University of Kwa-Zulu Natal) intended to be submitted to a journal for publication.

Chapter Four provides conclusions on the study and recommendations for future research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Obesity is a major global epidemic and a problem to society and health delivery systems. The growing prevalence of obesity in the population, historically considered a problem of high-income countries, is increasingly affecting developing countries (Cois and Day, 2015). The Southern African region mostly associated with low and middle in-come countries is affected by the rising trend of overweight and obesity, particularly women. Overweight and obesity are known risk factors for a number of chronic medical conditions, like cancer, raised blood glucose and heart diseases that in turn are primary drivers of health care spending, disability and death (Luciana et al., 2012).

Changes to lifestyle including rapid urbanisation , reductions in occupational activity, increased intake of highly processed foods and abdominal obesity are considered risk factors for non-communicable diseases or chronic diseases as these cluster of diseases are called (Fezeu et al., 2007). Studies clearly indicate that physical activity improves health and the quality of life. Engaging in physical activity is widely recognized as the primary means of prevention of chronic diseases, as well as for the treatment and rehabilitation of patients and it has beneficial effects on an individual's health and wellbeing (Anand et al., 2015).

2.2 Overweight and Obesity

2.2.1 Definition and Development

Overweight is defined as an excess amount of body weight that includes muscle, bone, fat, and water. Obesity specifically refers to an excess amount of body fat (Katzmarzyk, 2010). Medically, obesity is defined as a complex multi-factorial chronic disease that develops from an interaction of genotype and environment (Liu, 2014). Overweight and obesity are well understood to be a result of an energy imbalance resulting from consuming more calories than expended in physical activity (Benkeser et al., 2012). Too many calories in, too few calories burned.

The number of fat cells increases most rapidly during the growing years of late childhood and early puberty. After growth ceases, fat cells numbers may continue to increase whenever energy balance is positive (Rennard et al., 2007). Obese people have more fat cells than healthy weight people. Their fat cells are also larger and when energy intake exceeds expenditure, the fat cells accumulate triglycerides and increases in size. When the cells enlarge, they stimulate cell proliferation so that their numbers increase again (Rennard et al., 2007). When one's fat cells increase in number, size or both then a way is paved for obesity development.

2.2.2 Measurement of overweight and obesity

Overweight and obesity can be measured in several ways. These range from simple, useful and practical anthropometric measurements such as weight and height, from which body mass index (BMI) is derived and it is the most popular way. Waist circumference, waist-hip ratio (WHR) and skin folds thickness to the more highly developed and complex ways mostly used in research to determine percentage body fat. These include Hydro densitometry, Magnetic Resonance Imaging (MRI), computed Tomography (CT), Dual Energy X-ray Absorptiometry (DEXA), Bioelectric Impendence Analysis (BIA), and Air Displacement Plethysmography (Pengelly and Morris, 2009).

Body mass index is a measure of body fat based on height and weight; it is weight in kilograms divided by the square of height in metres (Gatineau and Dent, 2011). People with a BMI of >25 kg/m^2 are considered overweight and people with a BMI of >30 kg/m^2 are considered to be obese (Gómez-Ambrosi et al., 2012). A BMI higher than 30kg/m^2 is associated with a high prevalence of high blood pressure and diabetes, hyperlipidaemia and other metabolic diseases (Luciana et al., 2012).Table 1 shows the classification of overweight and obesity by BMI and waist circumference associated with chronic disease risk.

Waist circumference is used to measure abdominal fat deposition. It is generally agreed that fat deposited around the waistline increases the risk of mortality. It is because fatty tissue in this area secretes cytokines, hormones and metabolically active compound that can contributed to the development of chronic disease, particularly CVDs and cancers (Kin et al, 2006). Waist-to-hip ratio is the circumference of the waist (smallest part of the torso, usually slightly above the navel) divided by the circumference of the hips (largest part of the buttocks). This ratio may indicate body fat distribution and obesity and potential risk for certain diseases (McKinney et al., 2013). Waist –to-hip ratio values of >0.85 in women and >0.90 in men are considered requirements for weight control as they have and increased visceral adipose tissue (Pengelly and Morris, 2009).

Table 1: Classification of Overweight and Obesity by BMI, Waist Circumference and Associated Disease Risk

			Disease Risk* Relative to Normal Weight and Waist Circumference	
Classification	Body Mass Index (kg/m2)	Obesity Stage	Waist Circumference Women: >80cm	Waist Circumference Men:> 90cm
Underweight	<18.5	-	-	-
Normal	18.5 to 24.9	-	-	-
Overweight	25.0 to 29.9	-	Increased	High
Obesity	30.0 to 34.9 35.0 to 39.9	I 11	High Very high	Very high Very high
Extreme obesity	>40.0	111	Extremely high	Extremely high

*Disease risk for raised blood glucose, high blood pressure, and CVD

Adapted from American Academy of Family Physicians (2013).

2.2.3 Types of Obesity

Fat storage

Body fat distribution can be used to establish overweight and obesity. The quantity and location of fat in the body, as well as how much can predict health risks. Some people store fat in upper body areas while other holds fat lower on the body. The two patterns give rise to two patterns of obesity, namely android obesity and gynoid obesity (Patidar, 2013).

Android obesity

This is the type of obesity in which fat is stored primarily in the abdominal area, defined as a waist circumference greater than 102 in men and greater than 88 cm in non-pregnant women (IOTF, 2004). Though this type of obesity is more associated with males it is common in females too. Those females, who are under hormone treatment for the menstrual abnormalities or after childbirth, are more prone to this type of obesity. It occurs in females around menopause too due to thyroid gland's functional disturbance. It is a public health concern because of its association

with disease states as high blood pressure, insulin resistance, breast cancer, stroke, diabetes and CVDs (Patidar, 2013).

Gynoid obesity

This is a typical female pattern where excess fat stores accumulate in the periphery, specially hips, thigh, and bottom. Individuals with a gynoid fat distribution (often called 'pear' shape) face problems when growing old as the whole figure assumes a stooping posture and the spine is never erect due to the heavy hips and thighs. The vital organs affected mostly are the kidney, uterus, intestines, bladder and bowels (Patidar, 2013).

3.2.2 *Factors Affecting the Development of Overweight and Obesity*

Socio-economic factors and overweight and obesity

An inverse relationship has been found between body weight and socio-economic status (McLaren, 2007). People with a lower income tend to consume a high-fat, energy dense diet because it is more affordable than a healthier diet comprised of lean meats, fresh fruits, and vegetables (Jeffords et al., 2010). Baum et al. (2009), argue that overweight and obesity are inversely related to social and economic advantage and that poor health during childhood is associated with lower educational attachment, lower status, and more health problems in adulthood. In a study done by Mkhonto et al. (2012), higher socio-economic status was associated with decreased physical activity and increased prevalence of overweight and obesity. In another study conducted in Botswana on obesity in 707 adolescents in two different socio-economic status categories by Wrotniak et al. (2012), private school students and those with more assets had high prevalence of overweight and obesity (27.1%) compared with public school students (13.1%). In contrast in a study done in Kenya which demonstrated that urban women in the higher social economic group had a higher prevalence of obesity (Mbochi et al., 2012).

In many parts of Africa, being overweight or obese is usually viewed as desirable rather than a health concern (Mbanya et al., 2014). In a study in Kenyan slum residents (Perry and Ettarh, 2009), more than one-half of them underestimated their weights and over one-third of the women and men reported preference for body sizes that would otherwise be classified as overweight or obese. The high prevalence of obesity in black women of a lower socio-economic status could be due to a more tolerant social climate for obesity in these communities. Micklesfield et al. (2013), reported that approximately 40% of overweight black subjects considered their figures to be attractive. Overweight indicated a positive body image while obesity was less stigmatised and the consequences of being obese seemed to be less negative.

The notion could exist in low- income communities that fatness would improve the chance of survival in times of food scarcity (Matoti-Mvalo and Puoane, 2011). Reports suggest that black South African women viewed that large people are happy and healthy, whereas those who are slender are perceived to experience personal problems and that they may have disease such as HIV/AIDS. Micklesfield et al. (2013), showed that a reasonable percentage of obese women in South Africa did not want to lose weight. Matoti-Mvalo and Puone (2011), reported that urban Zulus associated obesity with wealth and happiness. Knowledge of the distribution of obesity by social class is essential as it would contribute to educating the public and inform the policy measures required for the necessary intervention to quell the rising trend and prevalence of obesity (Adediran et al., 2012).

Marital status and overweight and obesity

Important events in a person's emotional life have a quietly large influence in food and body weight (Mbochi, 2010). It has been shown that marital status can influence the body particularly in women although some research suggests it may be equally influential in men and women (NHMRC, 2003). The reason for this are not clear. It has been suggested, however, that there could be a reduction in energy spent courting, and increase in containment and social eating.

According to Mbochi et al. (2012), research dating back to the 1950s suggests links between body weight/obesity risk and marital status, marital progression, marital problems and marital termination. Longitudinally, evidence is more consistent, suggesting that marriage predicts weight gain on both men and women, whereas marital termination (through divorce or widowhood) predicts weight loss (Puhl and Heuer, 2010). There exists a positive relationships between the marital status and weight gain. Entry into marriage is associated weight gain while exit from marriage results in weight loss, but of a low magnitude (Ulijaszek, 2007).

Parity and overweight and obesity

Parity is yet another factor, unique in women, that is seen to contribute to overweight and obesity. Motherhood has been linked to greater weight gain, only some of which is likely to be attributable to weight gained during pregnancy (Crawford and Jeffery, 2005). Having children is likely to impact on a women's ability to adopt healthy habits (Andajani-Sutjahjo et al., 2004).

Nutrition and overweight and obesity

Nutrition transition is a descriptive term for shifts in dietary patterns, usually at the community or population level (Steyn and Temple, 2014). According to Mattei et al. (2012), nutrition transition can be visualized as a shift from periods of famine, to those of receding famine, to those of nutrition-related chronic disease lifestyle resulting from increased affluence. The countries in the SSA are still in the early of the nutrition transition, while a few have already reached a position where change in dietary patterns are affecting health outcomes in a significant proportion of the population (Abrahams et al., 2011). Studies have theorized that SSA have both a high prevalence of stunting children and of overweight and obesity in mothers. Abrahams et al. (2011), indicate that child malnutrition and maternal overweight could both stem from poor socioeconomic conditions, lack of sanitation, and poor dietary variety.

Approximately 16 million disability adjusted life years and 1.7 million of deaths worldwide are attributable to low fruit and vegetable consumption (WHO, 2014). Mattei et al. (2012), indicates that from a biological perspective there is a convincing evidence that moving from traditional diet high in carbohydrate and fibre and low in fat and sugar to a westernized diet high in energy, saturated fat, sodium, and sugar and low fibre increases the risk of obesity, high blood pressure, stroke, diabetes, ischaemic heart disease and certain cancers. Consuming more calories than the body needs leads to weight gain. Alcohol can increase the risk of weight gain by the calories it provides and by increasing one's appetite for food (Mitchell et al., 2009).

A growing issue related to obesity is an individual's diet. There has been an increasing amount of effort put into the health and wellbeing of an individual with little focus on teaching good nutritional practices and areas that need to be looked into more thoroughly such as fats, portion sizes, and sugars (Jeffords et al., 2010). Proliferation of fast food outlets in major cities in developing nations and exposure to and consumption of food high in fat and refined food high in calorie has been implicated in the increase of prevalence of obesity and overweight (Benkeser et al., 2012).

Studies have shown that there is convincing evidence that saturated fat and trans-fat increase the risk of coronary heart disease and that replacement with mono-saturated and polyunsaturated fat reduces the risk. Adequate consumption of fruit and vegetables reduces the risk for CVDs, stomach cancer and colorectal cancer. It is also estimated that decreasing dietary salt intake from the current global levels of 9-12 grams per day to the recommended level of 5 grams per day would have a major impact on reducing blood pressure and CVDs (WHO, 2014).

Environmental Influence on overweight and obesity

The rates of obesity have continued to rise in the last three decades, even though the genetic pool remains unchanged. This is an indication that the environment has a role to play as far as overweight and obesity are concerned. The environment includes all the circumstances that we encounter daily that push us towards fatness or thinness (Rolfe et al., 2010). The environment exposes people to an abundance of high caloric, high fat foods that are readily available, relatively inexpensive, heavily advertised and reasonably tasty. Foods, especially fast foods, are available everywhere, all the time. Restaurant food especially fast food is a major player in the development of obesity (Brume, 2010).

Despite an abundance of evidence of the benefits of maintain a healthy weight and a physically active lifestyle, poor people continue to eat larger portion sizes than they should be eating (Mbochi, 2010). Sedentary adults in the United States eat an average of 500-800 calories per day than need to maintain weight. At that rate, they will gain a pound to a pound and a half a week (Marks, 2004). Food is available everywhere, and people are bombarded with food aid. There are fewer opportunities for exercise, and many places have no bike paths, sidewalks, or easily accessible stairways. Poor access to a supporting physical environment that encourage incidental and planned physical activity may contribute to overweight and obesity (Marks, 2004).

In low-income neighbourhoods the grocery stores may be poorly stocked with healthy fruits and vegetables, and such neighbourhoods may not be safe enough to get and walk around in. In addition from all economic backgrounds often eat for social, cultural, and emotional reasons not just for hunger (Mark et al., 2004).

Genetic disposition and overweight and obesity

Research has revealed the importance role of biological factors in the regulation of body weight. Some people are more susceptible than others to becoming overweight and obese. For instance basal metabolic rate (BMR) affects body weight and weight loss because some individual's fat cells also help determine to amount of weight loss that is possible (Foster, 2002). Obesity is also partially determined by a person's genetic make-up, genes involved in weight gain increase the risk of susceptibility of an individual to the development of obesity when exposed to an adverse environment.

The Social behavioural dimensions and overweight and obesity

In the Western world, social stigmatism against obesity and a widespread obsession with trying to remain lean and have probably helped limit to some extent the rate rise in obesity. However,

studies in African Americans have reported a lack of social negativity towards obesity especially in women. With a few exceptions there have been very few reports of attitude of obesity in native African populations (Prentice, 2006). Similarly, in many SSA countries an increased level of body fat is associated with beauty, prosperity, health and prestige, despite its negative impact on health. Thinness is contrast is perceived o a sign of ill health or poverty and is something to be feared and avoided, particularly when it has been associated with HIV/AIDS. In disadvantaged communities in South Africa, food is highly valued because food security has not been ensured (Jamison, et al., 2006).

A study conducted by Prentice (2006), in Gambia using the body image assessment for obesity and figure rating scale silhouette charts to explore body weight perceptions among urban adults and to study age and gender differences confirmed a high level of body satisfaction and obesity acceptance especially among and about middle aged women. The results confirmed that Gambians were more obesity tolerant than white Americans. This satisfaction with a larger body size often extends to an actual desire to gain and maintain weight.

Other factors promoting weight gain include smoking cessation, excess alcohol intake, drugs or medication and disease states, cultural influences and body image. A large body stature is associated with wealth and absence of disease or health. Television advertising, long episode of using internet, high intake of fast foods and increase in food intake outside the home have also been reported to be associated with obesity (Musaiger, 2011).

Sex differences in health, overweight and obesity

Social inequality, poverty and inequitable access to resources, including health care, result in a high burden of chronic diseases among women worldwide. Although women generally tend to live longer with chronic diseases than men, they are often in poor health (WHO, 2004). Women have a higher morbidity than men. Jamison et al. (2006) , studied the relation to expect lost healthy years at birth. Whereas men lose 7.8 years over their lifetime as a result of poor health, women lose 10.2 years. Women spend about 15% of their lives in unhealthy conditions while men spend just about 12%. Therefore living longer lives should not be taken to indicate better health for women (Jamison et al., 2006).

Obesity impacts more on women than men, although more men than women tend to be overweight. A number of physiological process are believed to contribute to an increased storage of fat in females. Females have a tendency to channel extra energy into fat storage while males use more of this energy for protein synthesis. The patterns in females contribute to further positive

energy balance and fat deposition (WHO, (2000). Women generally have higher percentage of body fat than men, and there are indications that the basal fat oxidation is lower in females compared to males, thereby contributing to a higher fat storage in women (Rolfe et al., 2010).This explains why women have a more difficult time losing fat in general, and from the hips and thighs in particular (Rolfe et al., 2010). Furthermore, women rely on fat stores more than men for reproduction. Essential body fat in women may account for 12% of fat total body weight and 3% in men (Nikpartow et al., 2012).

Pregnancy and menopause are significant factors in the development of obesity in women, suggesting that fluctuations in reproductive hormone concentrations uniquely predispose women excess weight gain. Serotonin, which contributes to the regulation of food intake, is regulated differently between the sexes. As BMI increases, the amount of serotonin synthesis decreases, presumably to indicate satiety at lower levels of food intake. In men, this decrease occurs when men BMI classifying them as overweight whereas women do not experience this drop in serotonin synthesis until they reach a BMI classifying them as 'obese' (Rennard et al., 2007). Furthermore, when losing weight, men are more likely to lose fat within abdomen, whereas women are more likely to lose fat that resides just under the skin. Because of this difference, men experience greater declines in triglyceride levels and increases in HDL cholesterol levels compared to women losing the same amount of weight (Rennard et al., 2007).

2.2.5 *Prevalence and Trends of Overweight and Obesity*

Global trends of overweight and obesity

The prevalence of obesity is increasing rapidly in both developed and developing nations. It has reached epidemic proportions globally and the evidence suggests that the situation is likely to get worse (Adediran et al., 2012). Kelly et al. (2008), estimated total numbers of overweight and obese adults in 2005 as 922-951 million and 388-405 million respectively. In 2010, the World Obesity Federation estimated that over one billion adults were overweight and 475 million were obese globally), with the majority of which resided in developing countries in Latin America, Africa, and Asia (WHO, (2010). The WHO (2014), reported the prevalence of overweight and obesity on adult in 2008 as; 28% and 9% for both sexes, men 18% and 9% and women 40% and 14% respectively.

The overweight and obesity rates are higher in women than in men. Once considered a problem for high income countries overweight and obesity rates are increasing worldwide with developing

countries experiencing unprecedented increases (Lokuruka, 2013). The increases in overweight and obesity are felt most dramatically in the urban settings. In a study done by Steyn et al. (2014), overall, overweight and obesity (BMI≥25kg/m^2) was 43% with high prevalence in urban women with high socioeconomic status than rural areas. Dake (2013), in a study in Ghanaian women in 2003-2008 year periods indicated that the prevalence of overweight and obesity increased from 25.5% to 30.5%.

In a dietary survey done by WHO revealed that as Latin American countries emerge from poverty, there is an increasing trend in obesity especially in urban setting. In contrast, in the middle income countries of the region obesity is seen to decrease as incomes rise, especially among women. In Latin America, nearly a quarter of the population is obese, and prevalence has increased to a greater magnitude in Mexico, Argentina and Chile (Rivera (Rivera et al., 2004). The increased obesity rates are explained by dietary change and increased inactivity especially among low-income groups who improve their incomes but predominantly by high fat, high carbohydrate and energy-dense foods (WHO (2014).

Regional trends of overweight and obesity

The United States has the highest rates of obesity among developed countries (32%), in the adult population (Centres for Disease Control 2009). The prevalence is higher in women (35%) than in men (33%) and the rates varies according to gender and ethnicity. The people with low income in these states are the most affected by the prevalence of overweight and obesity are heavily affected as exposed to cheap unhealthy foods as they cannot afford healthy foods. Therefore, the low income has an 'obesogenic' effect (Wang et al., 2011). Studies show that the minorities are the hardest hit with obesity in New York in the United States. The numbers so high it is the second most preventable cause of death in the United States next to smoking. The black American population show fast increasing obesity among minorities (Wang and Beydoun, 2007). More than 30% of annual deaths in the United States are reported to be associated with obesity related ill-health complications (Centres for Disease Control 2009).

In Africa, South Africa has the highest prevalence rates of overweight and obesity with 70% of women and a third of men classified as overweight or obese (Oni et al., 2015). Its prevalence among urban black women of 36% in South Africa already exceeds that of black women in the United States (Jamison et al., 2006). The prevalence of obesity on South African women almost doubles that of urban women in Gambia and Tanzania (Jamison et al., 2006). In a comparative

study between Kenya and South Africa, in both countries the prevalence of overweight and obesity was higher in urban areas than in rural areas (Steyn et al., 2013).

Australia has one of the highest prevalence of overweight and obesity among developed countries (Colagiuri et al., 2010). In a national survey done in Australia, 63% of adults were above a healthy weight (35% overweight, 28% obese). The prevalence is higher in men (70%) than in women (56%) (Australian National Preventive Health Agency, 2014). The prevalence rates is influenced by a range of social and economic factors such as level education, financial stress, rurality, availability of fresh food and the availability of green space, the effects are greater and more complex in women (Colagiuri et al., 2010). In China, once considered to have the leanest populations is fast catching up with West. Studies show an increase of two to three fold in overweight and obesity prevalence rates over the 10 year time period (Journal of Obesity 2010). According to Ouyang and Chen (2011), the increase in overweight and obesity prevalence in China is associated with changes to the traditional diet, reduced levels of physical activity, increased sedentary lifestyles, lack of knowledge on obesity, and traditional social attitudes towards body fatness.

Overweight and obesity in Africa

As already highlighted earlier, in developing countries there is a shift from traditional diets and lifestyles to western diets and lifestyles particularly in rapidly growing urban population which is a major cause of obesity (Popkin et al., 2012). In theory urbanisation and westernization lead to decreased physical activity and increased food supply including access to high caloric fast foods and sweetened sugar (Benkeser et al., 2012). In the context of rapid urbanisation in Africa, primarily driven by rural-urban migration, the new migrants have been shown to adopt to new urban lifestyles which ultimately predispose them to becoming obese even though their socio-economic status might be lower than that for long term residents (Abubakari et al., 2008).

In North Africa in a study done by Toselli et al. (2014), found that the prevalence of overweight and obesity was higher in females and urban people than males and rural dwellers. Musaiger (2011), in a study in eastern Mediterranean region revealed that the prevalence of overweight and obesity could be related to cultural values, as North African population favour larger body size among women as a sign of fertility, healthiness or prosperity.

The prevalence of obesity in South African populations show that urban had a higher prevalence than rural, especially among women (Alaba and Chola, 2014). In a study done in South Africa

Puoane et al. (2002), 60% of black women were either overweight or obese. In another done on rural population in South Africa showed that women had a high prevalence of overweight and obesity than men (Mkhonto et al., 2012).Evidence from a South African demographic surveillance site finds that overweight and obese African women are at higher risk of high blood pressure (Case and Deaton, 2006), and that the two largest killers among residents aged 50 and above are stroke and congestive heart failure both diseases associated with obesity. In a study done by Wahab et al. (2011), in Nigeria the prevalence of overweight (53.3%) and obesity (21.0%) with a significantly higher in females compared to males; overweight 62.0% versus 41.9%, and obesity 29.8% versus 9.3% respectively.

In another study in Nigeria the overall prevalence of obesity indicated by waist circumference was 33.8% with 8.9% in men and 53.8% in women (Amole et al., 2011). In Tanzania, prevalence of overweight and obesity was higher among women than men in urban areas (Njelekela et al., 2009). The prevalence of overweight and obesity in a study in Botswana revealed that women had a higher rates than men; overweight was 23% among women and 13% in men, obesity was 15% on women and only 3% on men (Letamo, 2011). With the rise in socio economic status, urbanisation , and diminishing physical activity, the prevalence of obesity has also increased in Botswana, Namibia and Zimbabwe. Throughout, both North and Sub-Saharan Africa, overweight and obesity and physical inactivity in both sexes is associated with high social status, fertility, good health and prosperity (Kayima et al., 2013).

Trends of overweight and obesity in Zimbabwe

Zimbabwe is a landlocked country in the Sub-Saharan Africa Region: bordered by Mozambique, South Africa, Botswana, and Zambia. It has a population around 13million and the prevalence of obesity according to WHO, (2014) is 7.0% for the adults, 11.6% in men and 24%in women. In a Zimbabwe Demographic Health Survey done 2010-2011, the findings showed that only 7% of Zimbabwean women are too thin in contrast, 31% of women are overweight or obese. Overweight and obesity is higher in urban areas than in rural areas (41% and 26% respectively) and increases with age and wealth. In the World Data Atlas, Zimbabwe Adult obesity prevalence for females showed an increase from 17.1% in 2010 to 18.5% in 2014. Like many low-income countries the prevalence of overweight and obesity in Zimbabwe is associated with high social status, good health and prosperity. The data on prevalence of overweight and obesity, chronic diseases and physical inactivity is very scanty on Zimbabwean population. The little available on Chronic diseases morbidity and mortality was mostly done in hospital or on a clinic environment.

2.3 Chronic Diseases Risk

Chronic diseases are characterised by a long incubation period, a long duration of illness, a complex and poorly understood aetiology and a resistance to cure (Powell et al., 2012). The burden of chronic diseases is rapidly increasing worldwide. Chronic diseases are the leading causes of morbidity and mortality in most low-and middle-income countries (Costa et al., 2008). In terms of attributable deaths, leading non-communicable disease risk factors global is raised blood pressure (to which 13% of global deaths are attributed), followed by tobacco use (9%), raised glucose (6%), physical inactivity (6%) and overweight and obesity (5%) (WHO, 2014).

The proportion of the burden of chronic diseases is expected to increase to 57% by 2020 (World health report 2009). In five out of six regions of WHO, deaths caused by chronic diseases dominate the mortality statistics, although HIV/AIDS, malaria and tuberculosis, along with other infectious diseases, still predominate in Sub-Saharan Africa and will do so for the foreseeable future. It is further reported that, 79% of all deaths worldwide that are attributable to chronic diseases are already occurring in developing countries (WHO, 2013).

Obesity is the sixth most important risk factor contributing to the overall burden of disease worldwide (Haslam et al., 2006). Obesity has reached epidemic proportions globally, with more than 1 billion adults' overweight- at least 300 million of them clinically obese- and is a major contributor to the global burden of chronic disease and disability (WHO, 2013). Strum, (2002), suggests that obese individuals self-report chronic conditions such as raised blood glucose, high blood pressure, asthma, heart disease, and certain forms of cancer 67% more than normal weight individuals with the history of smoking or heavy drinking. Kengene and Mayosi (2012), indicated that the prevalence of raised blood glucose, high blood pressure, and high-serum cholesterol increases with increasing body weight. Venkitachalam et al. (2012), associate a high BMI with CVDs risk factors, including high blood pressure, high total and low density lipoprotein (LDL) cholesterol, high triglyceride levels, and low high density lipoprotein (HDL) cholesterol.

Premature death is a major consideration when evaluating the impact of chronic diseases on a given population, with approximately 44% of all chronic disease deaths occurring before the age of 70 years. In low and middle income countries, a higher proportion, 48% of all chronic disease deaths are estimated to occur in people under the age of 70 years, compared with high-income countries (26%) (WHO, 2014). The difference is even more marked for chronic disease deaths in younger age ranges in low and middle-income countries. Twenty-nine percent of chronic disease deaths occur among people under the age of 60 years, compared to 13% in high-income countries.

Obese people are far more likely to die from CVDs driven primarily by high blood pressure, loss of glycaemic control and hyperlipidaemia, and combined vastly accelerate atherosclerosis (Apovian and Gokce, 2012). With women, as they grow older especially on menopause they change in body mass and body composition. They gain weight particularly in the abdominal area, which causes numerous health problems. Longitudinal studies show that the direct correlation between obesity and fatal CVDs is strongest in women with very high intra-abdominal fat (Fogelholm, 2010). chronic obstructive pulmonary disease, which has been linked to women's exposure to smoke an indoor air pollution largely as a result of the households roles contribute significantly in cause of death in women (WHO, 2009). Metabolic risk factors for diet related chronic diseases for Zimbabwe, 2008 (Figure 1).

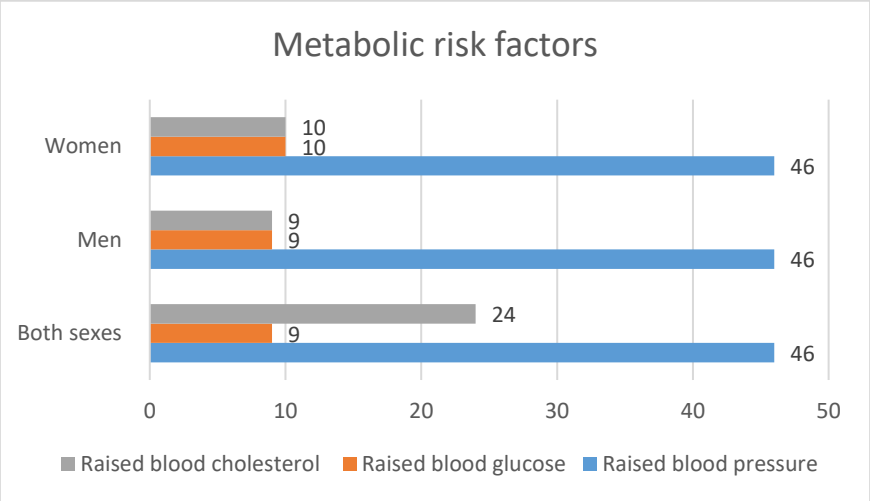

Figure 1: Metabolic risk factors for diet-related chronic diseases, Zimbabwe-2008(%)
Adapted from WHO (2014).

Information about NCD-related mortality, morbidity data are important for the management of health-care systems and for planning and evaluation of health service delivery. However, in most low-income and middle income countries reliable data on NCD morbidity is scanty. In the study only three chronic diseases were chosen (blood pressure, blood glucose and blood cholesterol), hence a more detail on literature on these will be reviewed.

2.3.1 Blood Pressure

High blood pressure is a chronic, sometimes acute, condition characterised by abnormally raised blood pressure resulting in end organ damage (Mungati et al., 2014). High blood pressure, known

as high or raised blood pressure is a condition in which the blood vessels have persistently raised pressure (WHO, 2013). Blood pressure is recorded as two numbers written one over the other (systolic pressure/diastolic pressure) in mmHg. Systolic blood pressure in blood vessels happens when the heart contracts, or beats. Diastolic blood pressure is the lowest pressure in blood vessels in between heart beats when heart muscle relaxes. Normal blood pressure is 120mHg over 80mHg (120/80), high blood pressure is ≥140mHg over ≥90mHg (≥140/90). Table 2 show blood pressure categories

Table 2: Blood pressure categories; Presented using Systolic (mmHg) and Diastolic (mmHg) pressure.

Category	**Systolic pressure (mmHg)**	**Diastolic pressure (mmHg)**
Optimal	<120	<80
Normal	120	80
Pre-Hypertensive	120 to 139	80 to 89
High blood pressure Stage 1	140to 159	90 to 99
High blood pressure Stage 2	160	100
High blood pressure Crisis	>180	>110

Adapted from National Heart, Lung and Blood Institute (2016)

High blood pressure is often referred to as the silent killer, because it often causes no symptoms and if left uncontrolled, increases risk for heart attack and stroke. The increasing prevalence of high blood pressure is attributed to population growth, ageing and behavioural risk factors such as unhealthy diet, harmful use of alcohol, lack of physical activity, excess weight and exposure to persistent stress (WHO, 2014).the growing prevalence of obesity is increasingly recognised as one of the most important risk factors for the development of high blood pressure. It is estimated that 75% of the incidence of high blood pressure is related directly to obesity (Landsberg et al., 2013).

According to Krishnan et al. (2007), risk factors for developing high blood pressure can be modifiable (as in obesity, stress, excessive dietary salt, physical inactivity), or non- modifiable (increasing age, black race, family history and female sex). According to Akinkugbe in Mungati (2014), high blood pressure tends to rise with increasing age due to the stiffening of the arterial walls. Females usually have a higher BMI which is associated with higher prevalence of high blood pressure (Damasceno et al., 2011). The consequences of high blood pressure can be

prevented by adopting simple lifestyle measures; achieving and maintaining a healthy body weight, engaging in regular physical activity at least 30 minutes of regular, moderate-intensity activity on most days, eating a healthy diet, avoiding sugar and saturated fats intake and avoiding tobacco use, smoking increase the risk of high blood pressure and cardio-vascular diseases (Krishnan et al., 2007). Treatment of high blood pressure and managing other medical conditions such as raised blood glucose and high cholesterol helps in reducing complications. About 60% of people who have raised blood glucose have high blood pressure (WHO, 2011).

Globally CVDs accounts for approximately 17 million deaths a year, nearly one third of the total of these complications of high blood pressure accounts for 9.4 million deaths worldwide every year. High blood pressure is responsible for at least 45% of deaths due to total ischemic heart disease mortality, and 51% of deaths due to total stroke mortality (WHO 2013). According to Bromfield and Muntner (2013), in low and middle income countries nearly 80% of deaths are due to CVDs. Researchers found out that the average blood pressure levels in high-income countries have decreased significantly, however, average blood pressure has increased in middle and low income countries, particularly in south Asia and sub-Saharan Africa. The prevalence of high blood pressure is highest in the African region at 46% of adults aged 25 years and above, while lowest prevalence at 35% is found in America (WHO, 2013).

According to Stockweletal in Chimberengwa (2013), in a study done in USA on awareness, treatment and control of high blood pressure, less than one third of the sample had controlled blood pressure, almost half had high blood pressure and high blood pressure awareness and treatment were inadequate.

In another study done by Addo et al. (2007), the prevalence of high blood pressure ranged between 11% in all participants in rural Cameroon and 47% in females in South Africa. Marwiro (2010), in their study found that the prevalence of high blood pressure was 38.4% and it was higher in females than in males, while the prevalence of undiagnosed high blood pressure was 14.2%. In a systematic review done in Africa on high blood pressure the findings suggested the prevalence of high blood pressure is increasing and many individuals with high blood pressure where not aware of their condition. In 1990 high blood pressure cases were estimated at 54.6 million cases, 92.3 million in 2000, and 130.2 million cases in 2010 and a projection increase to 216.8 million cases of hypertension by 2030 (Adeloye et al., 2015).

Zimbabwe is experiencing an epidemiological transition where the prevalence of high blood pressure is rising due to Western diets and life style (Mungati et al., 2014). In a study done in Zimbabwe among 354 participants showed a high prevalence of uncontrolled high blood pressure 67.2% among the participants, with a mean systolic pressure of 151.0mmHg and diastolic pressure of 92.6mmHg (Goverwa et al., 2014). In another study in Zimbabwe done by Mungate et al., 2012, they found that 41.4% of the respondents were hypertensive but not on treatment. Twenty-one percent of respondents on treatment had controlled high blood pressure with preponderance towards women. It was further noted that women and those staying in urban areas had higher mean blood pressure values.

In a study done in Zimbabwe high blood pressure was more prevalent to women than men (72.3% and 64.8%) respectively. It was more prevalent in urban with 71.8% than in rural population (68.5%) (Chimberengwa, 2013). Given the high cost of high blood pressure medication, relative income, in most population in low-income countries including Zimbabwe, increasing awareness and simple preventative measures can best improve high blood pressure morbidity and mortality.

2.3.2 *Blood Glucose*

Raised blood glucose comprises the majority of people with raised blood glucose around the world and is largely is the result of excess body weight and physical inactivity (Anjana et al., 2011). In 2012, an estimated 1.5million deaths were directly caused by raised blood glucose and another 2.2 million deaths were attributable to high blood glucose (WHO, 2014). Symptoms of raised blood glucose include excessive excretion of urine (polyuria), thirst (polydipsia), constant hunger, weight loss, vision damage and fatigue. Raised blood glucose is a major cause of blindness, kidney failure, heart attacks, stroke and lower limb amputation (Anjana et al., 2011). However, the consequences of raised blood glucose can be prevented or delayed by simple lifestyle measures like maintaining healthy body weight, regular physical activity, eating a healthy diet and avoiding tobacco use (Hall et al., 2011).

Blood test (fasting and random) and oral tolerance test are done to detect the high blood glucose. Blood glucose levels are measured in milligrams per decilitre (mg/d/L) or millimoles per litre (mmol/l). Table 3 show the general guidelines to interpret blood glucose results.

Table 3: Blood glucose general guidelines used to interpret the test results in milligrams/decilitre (mg/d/L) and millmoles/litre (mmol/l).

Fasting blood glucose test		
Milligrams/decilitre (mg/d/L)	**Millimoles/litre (mmol/l)**	**Interpretation**
100 mg/d/L	5.6 mmol/l	Normal
100-125 mg/d/L	5.6- 6.9 mmol/l	Preraised blood glucose
126 mg/d/Land above	Above 7 mmol/l	Raised blood glucose
Random blood glucose test		
200mg/d/L	11.1 mmol/l	Raised blood glucose
Oral Tolerance Test		
140 mg/d/L	7.8 mmol/l	Normal
140 -199 mg/d/L	7.8 – 11.0 mmol/l	Preraised blood glucose
200 mg/d/L	11.1 mmol/l	Raised blood glucose

Adapted from National Heart, Lung and Blood Institute (2016)

The relative risk of CVD for persons with raised blood glucose is double or more than that of persons without raised blood glucose. According to Bos and Agyemang (2013), increasing urbanisation and life expectancy are expected to lead to an increase in number of people with raised blood glucose. The rising levels of urbanisation are likely to lead to a high prevalence of obesity due to lifestyle changes such as changing diet and physical activity patterns. The likelihood of developing raised blood glucose and high blood pressure rises steeply with body fatness (WHO, 2013). About 80% of people with raised blood glucose are overweight or obese. Being overweight causes cells to change, making them resistant to the hormone insulin (insulin carries sugar from blood to the cells, where it is used for energy (Federation, 2006). High blood sugar is a major cause of heart disease, kidney disease, stroke, amputation and blindness (Inzucchi et al., 2015).

High blood pressure and obesity among patients with raised blood glucose in developing countries are perhaps even more harmful than in high-income countries, where access to health care and adequate prevention programs help manage cardiovascular risk factors and can delay complications (WHO, 2012). Two characteristics of raised blood glucose in SSA add to its morbidity and mortality, firstly the lack of health resources leads to late diagnosis and severe vascular complications and secondly, there is generally poor blood glucose control. Frequent hypoglycaemic and hyperglycaemic episodes occur with irregular meals among poor populations (Dalal et al., 2011).

Raised blood glucose which was once considered a disease of affluent societies, is now increasing in most developing countries including those in SSA at unprecedented rates (Ekpenyong et al., 2012). The International Diabetes Federation estimated that the prevalence of raised blood glucose in sub-Saharan Africa among people aged 20-70 years was 2.4% in 2003, with the majority of the burden carried by adults aged 40-59 years old. Shaw et al. (2010), indicate that the worldwide prevalence of raised blood glucose among adults aged 20-79 years was 6.4% affecting 285million adults in 2010, and will increase to 7.7%, and 439 million adults by 2030. Between 2010 and 2030 there will be a 69% increase in numbers of adults with raised blood glucose in developing countries and a 20% in developed countries. The current estimated prevalence of raised blood glucose in sub-Saharan Africa is 3.2% and is expected to rise to 3.4% by the year 2030 (WHO (2014).

Data published in 2013 by International Diabetes Federation (IDF) indicates a global raised blood glucose prevalence of 8.3% (382 million people) with an expected 55% increase (to 592 million people) by 2035 if the current trends persist. Raised blood glucose is slowly beginning to receive considerable attention as a public health issue in Africa especially following its recognition as a challenge to global health requiring concerted action (IDF, WHO, African Union (AU), 2006). Africa is expected to witness the greatest increase, rising from 19.8 million people with raised blood glucose in 2013 to 41.4 million in 2035 (Federation, 2013).

In a systematic review done with SSA 1999-2011, showed that raised blood glucose accounts for well over 90% of raised blood glucose in the region, and the prevalence proportions ranged from 1% in rural Uganda to 12% in urban Kenya. A low to medium prevalence 0-7% was recorded in Cameroon, Ghana, Guinea, Kenya, Nigeria, South Africa and Uganda and a very high prevalence (>10%) was recorded in Zimbabwe Hall et al. (2011). Reported type 1 raised blood glucose prevalence was low and ranged from 4per 100, 000 people in Mozambique to 12 per 100,000 in Zambia. Gestational raised blood glucose prevalence varied from 0% in Tanzania to 9% in Ethiopia. In a study done on QwaQwa people in South Africa by Bradshaw et al. (2007), it was reported that the prevalence of raised blood glucose was 5%. Christensen et al. (2008) , in a survey done in Kenya show that the prevalence recorded for raised blood glucose was higher in urban areas 12%and then in rural areas 2%.

In low and middle income countries increase in prevalence of raised blood glucose is affecting more people because of the weak health delivery systems (Danaei et al., 2011). Due to the weak health delivery system in these countries the number of people with raised blood glucose who are undiagnosed, untreated and uncontrolled are higher, leading to an increase in raised blood glucose mortality (Danaei et al., 2011). To corroborate the above statement Hjelm and Mufunda (2012),

a study done in Zimbabwe the findings showed that, when people experience health problems related to raised blood glucose they used self-care measures to a limited extent. When they did it was frequently a combination of individual measures, households' remedies or herbs and prayers or holy water, and in some cases health care professionals were consulted for help (Hjelm and Mufunda, 2010). In another study done in Zimbabwe on beliefs about health and illness diagnosed with diabetics indicated a limited knowledge about both raised blood glucose and the body. It was further reported that the knowledge about raised blood glucose affected self-care and health seeking behaviours amongst Zimbabwean males and females with raised blood glucose (Mufunda et al., 2012). Guideline/protocols/standards for management of chronic diseases in Zimbabwe are available, however there is little done on the implementation since 2010.

2.3.3 *Blood Cholesterol*

Cholesterol is a waxy, fat like substance that's found in all cells of the body, needed to make hormones, vitamin D, and substances that help digest foods (National Heart and Institute, 2000). Cholesterol travels in the bloodstream in small packages called lipoprotein (Stone et al., 2014). Go et al. (2014), say total cholesterol is a measure of the total amount of cholesterol in blood and is based on the High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL) and triglycerides numbers. LDL cholesterol makes up the majority of the body's cholesterol and is known as 'bad' cholesterol because having high levels can lead to plaque build-up in arteries and result in heart disease and stroke (Figure 2).

HDL cholesterol absorbs cholesterol and carries it back to the liver, which flushes it from the body. It is known as 'good' cholesterol because having high levels can reduce the risk for heart disease and stroke (Stone et al., 2014). Triglycerides are a type of fat found in the body that are used for energy. The combination of high levels of triglycerides with low HDL cholesterol or high LDL cholesterol can increase the risk for heart attack and stroke (Go et al., 2014).

High cholesterol can cause atherosclerosis, a dangerous accumulation of cholesterol and other plaque on the walls of arteries (National Heart and Institute, 2002). Blood test is the only way to detect cholesterol levels. Cholesterol levels are measured in milligrams (mg) of cholesterol per decilitre (d/L) of blood or millmoles per litre (mmol/l). Table 4 shows the Total cholesterol levels general guidelines used to interpret the test results.

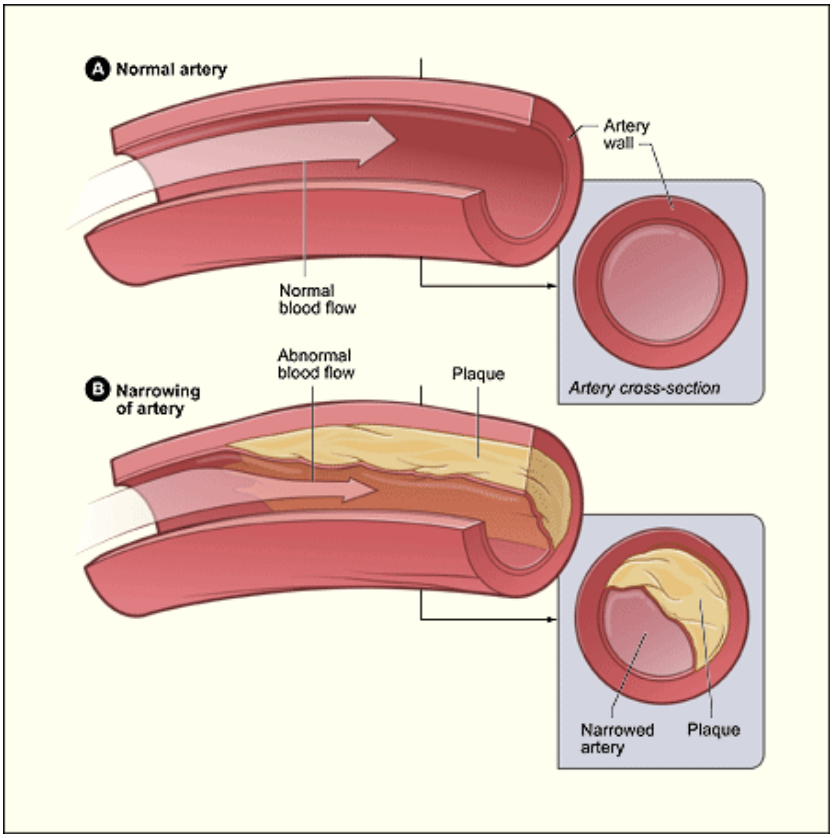

Figure 2: Shows cholesterol plaque build-up in the arteries.
Adapted from National Heart, Lung and Blood Institute (2016)

Table 4: Total cholesterol levels general guidelines to interpret the test results in milligrams per decilitre (mg/d/L) and millmoles per litre (mmol/l).

Milligrams/decilitre (mg/d/L)	**Millimoles/litre (mmol/l)**	**Interpretation**
Below 200 mg/d/L	Below 5.2 mmol/l	Desirable
200-239 mg/d/L	5.2- 6.2 mmol/l	Borderline high
240 mg/d/Land above	Above 6.2 mmol/l	High

Adapted from National Heart, Lung and Blood Institute (2016)

According to Go et al. (2014) , obesity is excess body fat linked to higher triglycerides and high 'bad' cholesterol levels, and lower 'good' cholesterol levels. In addition to high cholesterol, obesity can lead to heart disease, high blood pressure and raised blood glucose. Raised total cholesterol is often called 'the silent killer' because for most people there are no obvious signs and symptoms. The first sign of raised total cholesterol will be the presence of established heart and circulatory disease; angina, heart attack, stroke, pain on walking caused by narrowing and

blockage of the arteries (Carroll, 2012). A 1mmol/l lower cholesterol level is associated with about a 15to 20 percent lower stroke risk and 20 to 25 percent lower ischemic heart disease (Rodgers et al., 2006). Changing lifestyle measures can improve cholesterol levels; eating a healthier diet, adopting foods that actively lower cholesterol, being more physically active, avoiding tobacco use, managing alcohol intake and maintaining a healthy weight and reducing waist circumference (Garber et al., 2016).

Raised total cholesterol increases the risk of heart disease and stroke. Globally, a third of ischemic heart disease is attributable to high cholesterol. Overall raised cholesterol is estimated to cause 2.6million deaths (4.5% of total) and 29.7 million disability adjusted life years (WHO, 2014). The prevalence of elevated total cholesterol in the WHO Regions was highest in Europe 54% for both sexes, followed by Americas 48% for both sexes, African Region showed the lowest percentage 22% and South East Asia 29%. In 2008 the global prevalence of raised total cholesterol among adults (≥5.0mmol/l) was 39% (37% for males and 40% for females).

Raised total cholesterol is a major cause of disease burden in both the developed and developing world as a risk factor for Ischemic heart disease and stroke. In the United States 73.5 million adults (31.7%) have high low density lipoprotein (LDL) or 'bad' cholesterol (WHO, 2013). Globally, mean total cholesterol changed little between 1980 and 2008, finally by less than 0.1mmol/l per decade in men and women. In Ireland, a 30% reduction in the heart disease death rate has been attributed to 4.6% reduction of the population mean for total cholesterol. In Finland, 50% of the decline in ischemic heart disease mortality has been explained by the reduction of population blood cholesterol levels (WHO, 2014).

In a study done in South Africa on Profile and high prevalence of cardiovascular risk factors in Urban Black African populations, the findings show that almost a third of screened persons had at least one component of blood pressure raised, while 13% had raised blood cholesterol levels. Being overweight was significantly associated with elevated blood pressure and raised serum glucose and cholesterol levels (Tibazarwa and Damasceno, 2014). In a study done in Zimbabwe, hypercholesterolemia using a high cut-off level ≥6.5mmol/l was noted in 1.4% to 5.6% respondents and abnormally high prevalence noted when using a lower cut-off level of 5.2mmol/l (Zimbabwe Non-Communicable Diseases; Report, 2005). In a study done by Zhou et al. (2016), in found that many patients had some form of dyslipidaemia which implied an increased risk to the development of coronary heart disease. In another study on high cholesterol in South Africa by Norman et al. (2007), found that about 59% IHD and 29% of ischaemic stroke burden in adult males and females (30+years) were attributable to high cholesterol (≥3.8mmol/l), with marked variation by population group.

In low income countries around a quarter of adults had raised total cholesterol, in lower middle countries this rose to around a third of the population for both sexes. In higher income countries, over 50% of adults; had raised total cholesterol; more than double the level of the low income countries (WHO, 2014). Raised total cholesterol is influenced by a number of risk factors; certain health conditions, lifestyle measures, family history. Risk factor like family history and age cannot be controlled but behavioural risk factors; unhealthy diet, physical inactivity and obesity can be controlled (Carroll et al., 2012).

2.3.4 *Other Chronic Diseases*

Cancers

More than two thirds of all cancer deaths occur in low and middle income countries. Lung, breast, colorectal, stomach and liver cancers cause the majority of the cancer deaths. In high income countries, the leading causes of cancer deaths are lung cancer among men and breast cancer among women (WHO, 2014). In Sub-Saharan Africa, cervical cancer is the leading cause of cancer death among women. The risk factors for cancer include the four behavioural factors tobacco use, unhealthy diet, insufficient physical activity, and harmful use of alcohol (Jemal et al., 2011).

Being overweight increases the risk of developing certain cancers, including the following: breast, after menopause, colon and rectum, endometrium (lining of the uterus), gallbladder, and kidney. Fat cells may release hormones that affect cell growth, leading to cancer risk (WHO, 2012). Excess body weight (particularly abdominal fatness) exacerbates insulin resistance, which leads to the pancreas producing more insulin. Hyperinsulinemia increases the risk of colorectal and endometrial cancer, and possible pancreatic and kidney cancer (Wolin et al., 2010). Not only are obese people more susceptible to cancer, but their prognosis is significantly worse once diagnosed.

Men that are obese are 33% more likely to die from cancer, and obese women have a 50% chance of dying from breast cancer. Additionally to obesity, cancer is now being strongly linked to nutrition and physical activity status (Wiseman, 2008). The cancer most strongly associated with obesity are liver, colon and pancreatic cancer in men and breast, uterine, endometrial, kidney and cervical cancer in women (Calle and Thun, 2004). In women obesity is associated with cancers of the reproductive system, as excess body fat results in excess production of oestrogen by adipose stromal cell (Bray 2004). In a study by Walker et al. (2004), found that rural black South Africans had a very low incidence of breast cancer while in urban black women the incidence was much higher.

Osteoarthritis

Osteoarthritis is another health problem that is linked with overweight and obesity. Osteoarthritis causes pain and stiffness on the joints and is most related with aging and injury and often affects the joints of the hands, knees, hips and lower back. Extra weight may place extra pressure on joints and cartilage, causing them to wear away (WHO, 2012). Osteoarthritis is significantly increased with overweight individuals (Barker et al., 2014). Overweight and obesity is an important risk factor for osteoarthritis and is responsible for approximately 19%of cases in older women (WHO, 2012).

In a study done in an American population the results found an increased risk of osteoarthritis of the knees and ankles in overweight men and in obese women (Murphy et al., 2009). In a study in German the results showed that the prevalence of the majority of chronic condition and diseases rose with increasing BMI in both overweight and obesity in men and women were significantly associated with cardio metabolic risk factors and osteoarthritis, which was consistent with findings in the United States in a study done among adults aged 18 years and older (Messier et al., 2013).

Regarding to chronic diseases in SSA the majority of the published studies have been conducted in hospital or clinic settings and scanty on the general population. Non-communicable disease are strongly influenced by four behavioural risk factors; tobacco use, physical inactivity, harmful use of alcohol and unhealthy diet. The four behavioural risk factors lead to four key metabolic/physiological changes: elevated blood pressure, raised blood glucose and cholesterol levels, and excess body weight (WHO, 2016).

2.4 Physical Activity

It is recognised that physical activity is a major independent modifiable risk factor which has a protective effect on CVDs, stroke, raised blood glucose, colon and breast cancers, and is associated with other important health outcomes such as mental health, injuries and falls (Miles 2007).

The term physical activity refers to "…. any bodily movement produced by the skeletal muscles that results in energy expenditure". Physical activity affects total energy expenditure which is a sum of the basal metabolic rate, the thermic effect of food and the physical activity (Department of Health 1991).
Total energy expenditure (TEE) =Basal metabolic rate (BMR) + Thermic effect of food (TEF) + Physical activity (PA).

Physical activity is a complex multi-dimensional behaviour. Many different modes of activity contribute to total physical activity. These include occupational, household, transport and leisure-time activities. Exercise is a sub-category of leisure-time physical activity. Physical activity can be further categorised in terms of the frequency, duration and intensity (Hardman and Stensel, 2009). Physical activity associated with work, home and transportation has declined due to economic growth, technological advancements and social changes. Significant technological changes in the domestic, community and workplace environments have resulted in people spending more and more time in sedentary behaviours.

The human body has evolved in such a way that most of its systems (e.g skeletal, muscle, metabolic, and cardio-vascular) do not develop and function in an optimum way unless stimulated by frequent physical activity (Hallal et al., 2012). The modern environment has been described 'obesogenic' (Women's Health 2010). As work and domestic environments involve less manual labour hence to achieve the same levels of physical activity as previous generations, it is necessary to be more active in leisure time.

Physical inactivity is the fourth leading risk factor for mortality. Approximately 3.2 million deaths and 32.1 million disability adjusted life years each year are attributable to insufficient physical activity (Wiecha et al., 2012). People who are physically inactive have a 20 to 30 % risk of all-cause mortality compared to those who are physically active for most of the days of the week. In high –income countries, 41% of men and 48% of women are physically inactive, while in low-income countries 18% of men and 21% of women are physically inactive (WHO, 2014)

Physical activity is a behaviour that is associated with individual, social and economic factors as well as physical environments in which individuals live (Chau et al., 2012). Since the industrial revolution, the development of new technologies has enabled people to reduce the amount of physical labour needed to accomplish many tasks in daily lives. Although the technological revolution has been of great benefit to many populations throughout the world, it has come at a major cost in terms of the contribution of physical inactivity to the worldwide epidemic of non-communicable diseases (Hallal et al., 2012). Physical activity and exercise can improve health, functional capacity, quality of life and independence (Katzmarzyk, 2010).

Physical activity is a significant and amendable factor influencing an individual's health (De Meester et al., 2009). Obesity and many chronic diseases like cancer and CVDs are directly related

to sedentary lifestyle or physical inactivity. Many studies have proven that participation in 150 minutes of moderate physical activity each week (or equivalent) is estimated to reduce the risk of ischaemic heart disease by approximately 30%, the risk of raised blood glucose by 27% and the risk of breast colon cancer by 21to 25% (WHO 2014). Physical activity lowers the risk of stroke, high blood pressure, depression and obesity. From studies done evidence consistently shows that achieving the recommendation of at least moderate intensity physical activity on most days of the week reduce the risk of all-cause mortality (Chau et al., 2012).

Studies have shown that most women as they reach menopause stage they undergo various physical, social and psychological changes which affect their quality of life (Skrzypulec-Plinta et al., 2011). The menopause is a time of vasomotor, urogenital and mental changes in women. Approximately 86% of menopausal females suffer from hot flashes, joint pains, fatigue, depression, anxiety, vaginal dryness and other sexual problems. Skrzypulec-Plinta et al. (2011) recommends regular physical activity is as it is known to bring mental and physical benefits to among women. Physical activity maybe directly related to quality of life when it is conceptualised as a framework that incorporates health-related component, such as physical function, mental function, and social function (Nigg et al., 2010). Participation in regular physical (both aerobics and strength exercises) elicits a number of favourable responses that contribute to healthy life later in the years (Wareham et al., 2005). Ageing is a complex process involving many variables (genetics, lifestyle factor, chronic disease, obesity) that interact with one another, greatly influencing the manner in ageing (Katzmarzyk, 2010).

Strength exercises help offset the loss in muscle mass and strength. Regular physical activity improves bone health leading to a reduction in risk for osteoporosis and improved postural stability. This will reduce the risk of falling and associated injuries and fractures especially with women when they get older (Fox and Hillsdon, 2007). Obesity and chronic diseases are associated with depression and mental disorders. According to Fox and Hillsdon (2007), maintaining regular exercise provides a number of psychological benefits related to preserved cognitive function, alleviation of depression symptoms and behaviour and an improved concept of personal avid self-efficacy. Physical activity is the answer to many chronic diseases and obesity (De Meester et al., 2009). Despite all the health benefits of physical activity, research still indicates an increase in sedentary behaviour among the populations globally.

Dietary interventions

Dietary changes should be individualised and tailored to food preference and allow for flexible approaches to reducing calorie intake. Unduly restrictive and nutritionally unbalanced diets should not be used because they are ineffective in the long-term and can be harmful. People should be encouraged to improve their diet even if they do not lose weight because there are can be other health benefits (Baumer, 2007). It may be that different diets will work in different people. Factors recommend a blend of diets, emphasizing portion control, calorie-counting, self-monitoring, and gradual increases in activity starting with everyday activities. These simple measures do work if people practice them.

There is need to get away from talking about 'diets' and 'exercise'. Rather advise to 'make better food choices' and 'increase physical activity'. Patients on diets feel deprived and don't stick to them. They should instead be encouraged to choose foods they like to eat within the context of varied healthy choices. Adherence will improve and so will success (Marks and Yardley, 2004). It appears that the most successful method or most practical would be a change of lifestyle to include different things that would each contribute to weight loss or management. It may therefore be impossible to achieve results while using only one method. The WHO, (2004), reported that effective weight management for individuals and groups at risk of developing obesity involves a range of long-term strategies. These include prevention, weight maintenance management of comorbidities and weight loss. They should be part of an integrated, multi-sectorial, population-based approach which includes environmental support for healthy diets and regular physical activity.

Research has demonstrated protective effects of varying strength between physical activity and risk of several chronic diseases. In order to achieve the best results in preventing chronic diseases, the strategies and policies that are applied must fully recognise the essential role of diet, nutrition and physical activity (WHO, 2010).

2.5 Conclusion

Overweight, obesity and Chronic diseases that used to be associated with old age in high-income countries are becoming more prevalent in developing countries following the rapid increase in industrialization, urbanisation , economic development and globalization (WHO (2003). The literature clearly indicates that SSA countries are at risk of developing a high prevalence of obesity and NCD mortality more rapidly than has occurred in developed countries(Hansen et al., 2012). Physical activity and healthy eating should be encouraged among adults especially in SSA low and middle income countries with an increasing prevalence of overweight and obesity, as PA helps improve one's health and well-being.

CHAPTER THREE: MANUSCRIPT

The University of Kwa-Zulu Natal permits the dissertation to be presented in a manuscript format. The following manuscript will be submitted to African Journal for Physical Activity and Health Sciences.

OVERWEIGHT, OBESITY, CHRONIC DISEASE RISK AND PHYSICAL ACIVITY LEVELS OF RURAL AND URBAN WOMEN ZIMBABWE.

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3.1 Abstract

Introduction:

In developing countries there is a shift from traditional diets and lifestyles to western diets and lifestyles particularly in rapidly growing urban populations. This is a major cause of overweight and obesity. Obesity is a well-recognised risk factor for various chronic diseases. Chronic diseases are the largest cause of death in the world. They include cardiovascular disease, some cancers, chronic lung diseases and raised blood pressure. Maintaining a physically active lifestyle by doing regular moderate physical activities helps to keep a healthy weight and lower the risks of chronic diseases.

Aims:

The aim of this study was to compare weight, chronic risk diseases and physical activity levels of rural and urban women in selected Zimbabwean communities.

Methods:

A cross sectional descriptive and comparative design was followed in the study. The study population included all black Zimbabwean women aged 18 to 60 years residing in Bulawayo Metropolitan Province (Urban) and Matabeleland North Province (Rural). A sample size of 280 women participated in this study. One hundred and forty were urban residents from high density suburbs and 140 were rural residents. Anthropometric variables (mass, stature, waist and hip circumferences) were measured. Three questionnaires were administered; International Physical Activity Questionnaires (IPAQ), Quality of Life, and Nutritional questionnaires. Descriptive statistics including means and standard deviations were used. The Chi-square goodness-of-fit-test, a univariate test was used for categorical variables to test response options and the independent t-tests and Chi-square test of independence were used to compare group cases and the significance was set at $p \leq 0.05$. The SPSS version 22 statistical package was used to conduct data analysis.

Results:

The average weight for urban women 71.19±15.23kg was significantly higher than that for rural women 66.58±13.74kg, t (278) = -2.657, p=0.008. When considering Body Mass Index (BMI) classification, a significant number were either normal (117) or overweight (96), χ^2 (4) =181.500, $p<0.0005$. There was a significant difference was indicated between rural and urban women in terms of BMI ($p = 0.009$). There was a significant relationship between age and BMI ($p < 0.05$). Older women 30 years and above were classified as overweight and obese compared to the

younger women. There was a significant difference between urban and rural women 0.80± 0.60 and 0.78± 0.68), t (278) = -2.055, p= 0.003 in terms of waist to hip ratio (WHR). On chronic disease risk the urban women were at high and very high risk, while rural women were not at risk ($\chi 2$ (4) = 11.762, p=0.019). There was no significant difference in blood glucose levels between urban and rural women. A significant difference was shown across age groups of blood glucose levels (Welch (3, 51.868) = 3.205, p=0.031). A significant difference across age groups of cholesterol was noted; levels (F (3, 133) = 7.123, p < 0.0005).

There was a significant relationship between location and blood pressure p=0.025, with rural women having a higher raised blood pressure than urban women. Both rural women and urban women were physically active and a significant difference was noted in the transport domain, t (278), 2.002, p=0.46. There was no significant difference in quality of life between rural and urban women. There was a significant difference between energy consumption and location, t (278) = -5.202, p<0.0005. Urban women had significantly high protein consumption p=0.007, and fat consumption p<0.0005.

Conclusion:

The study findings highlight a higher prevalence of overweight and obesity in urban women compared to rural women in terms of BMI and waist to hip ratio. The Zimbabwean women show an increased risk for chronic health problems with higher prevalence in urban women than rural women especially raised blood pressure. There was a low prevalence of raised blood glucose in both the groups. Raised blood cholesterol prevalence was higher in urban than rural women. Both rural and urban women had good quality of life scores. Urban women had high consumption of macronutrients than rural women. Both urban and rural women showed high levels of physical activity.

Key words

weight, overweight, obesity, chronic diseases, physical activity, women

3.2 Introduction

Overweight and obesity are well understood to be a result of an energy imbalance caused by consuming more calories than equivalently expended in physical activity (Benkeser et al., 2012). Overweight and obesity is assessed using BMI which is a measure of body fat based on height and weight (Gatineau and Dent, 2011). According to WHO standards BMI< 18.5kg/m^2- underweight, 18.5 to 24.9kg/m^2 - normal, 25.0 to 29.9kg/m^2 -overweight, >30.0kg/m^2- obesity. According to Walter et al. (2009), obesity and overweight has a major detrimental implication on the body. It increases the work of the heart and leads to anatomical changes within it and alters pulmonary, endocrine and immunological functions with subsequent adverse effects on health.

The obesity problem may have been distributed unevenly across populations at first but the overall problem is largely due to urbanisation , change in work structure and technology, increased access to greater amounts of food, especially more calorically dense foods, and more leisure time and sedentary activities (Jeffords, 2010). Mehio Sibai et al. (2010), indicated that many developing countries have been regarded as countries in transition experiencing a shift in disease type and prevalence, closely linked to rapid urbanisation, economic growth and technological advances. The prevalence of overweight and obesity has frequently been highest among wealthier, more educated and urban people in low and middle income countries contrary to high income countries (Neuman and Koren, 2016).

Urbanisation is on the rise in developing countries and has been accompanied by new technologies that promote sedentary lifestyles. According Popkin et al. (2009), due to accessibility to private cars, television, and household appliances, the population as a whole is engaging in less physical activity. Popkin et al. (2012), in the same vein indicates that the shift in disease burden has been largely attributed to the ongoing nutrition transition and lifestyle changes characterised by changes in food supply and intake and reduced physical activity at the workplace and leisure. The intake of attractive energy dense food with undesirable composition, increased consumption of animal fats and sugars and reduced consumption of dietary fibre, along with a lack of sufficient physical activity has added to the overall increased percentages of overweight and obese populations (Kelishadi, 2007).

Physical activity has substantial health benefits (De Meester et al., 2009). Keeping active can help people stay at a healthy weight or lose weight (Costill et al., 2008). It can lower the risk of heart disease, raised blood glucose, cancers, as well as reduce the risk of developing type 1 and type 2 diabetes , stress and boost mood (Costill et al., 2008). Physical activity in most sub-Saharan Africa

is part and parcel of daily routine of walking searching for water and gathering food, and it is more common in rural areas compared to urban areas since the rural populations rely on walking as a means of transport and often have labour intense agricultural activities as their main occupations (Mbanya and Ramiaya, 2006). According to Kirk et al. (2010) et al. (2010), levels of physical activity are in part determined by individual characteristics as well as by environmental factors, and these factors deserve more attention than they have gotten to date, because they have a large potential impact on obesity on a population level.

Overweight and obesity are known risk factors for a number of chronic medical conditions like cancer, raised blood glucose, or heart diseases that in turn are primary drivers of health care spending, disability and death (Bahia et al., 2012). As of 2014, the WHO estimated that more than 1.9 billion adults, 18 years and above were overweight and of these over 600 million were obese, with higher rates for both conditions among women than men (38% of men and 40% of women) overweight, (11% of men and 15% of women) obese. In many developing countries research and investment in health has been mainly devoted to infectious diseases despite the growing need to address chronic diseases with more effort and resources. According to Abegunde et al. (2007), chronic diseases are deadlier in developing countries than in industrialized ones and the discrepancy is even greater for women than men. Ng et al. (2014), advocate that worldwide, the proportion of adults with a BMI of 25kg/m^2 or greater increased between 1980 and 2013 from 28.8% to 36.9% in men and from 29.8% to 38.0% in women.

Obesity is rapidly establishing itself as a public health problem in several developing countries with urban communities having a higher prevalence. In Sub-Saharan African, South Africa and Seychelles have the highest prevalence of overweight (over 50%) of the total population. (Ng et al., 2014). The prevalence of overweight and obesity in urban areas ranges from about 23% in Malawi to 35% in Niger and Ghana and 38% in Kenya (Ziraba et al., 2009). Overweight and obesity are the major risk factors for chronic health problems. The World Health Organisation (2015) reports that there will be a decrease in chronic diseases risk in western countries due to prevention strategies hence most future increase in chronic diseases mortality will occur in developing countries as health and environmental conditions gradually change.

Overweight and obesity are risk factors of chronic diseases such as CVDs, raised blood pressure, type 2 raised blood glucose, certain cancers (Cappuccio et al., 2008). Deaths form CVDs and raised blood glucose are highest in low and middle income countries and lowest in high income countries. Raised blood pressure and obesity among patients with type 2 raised blood glucose

mellitus in developing countries are perhaps even more harmful than in high income countries, where access to health care and adequate prevention programs help manage cardiovascular risk factors and can delay complications (WHO, 2012).

Zimbabwe is a landlocked country in the SSA region, bordered by Mozambique, South Africa, Botswana and Zambia. It has a population of around 13million with 38.6% of the population living in urban areas. The World Health Organisation, (2014) Global nutrition report indicated the prevalence of overweight and obesity as (29% and 9% respectively) for adults with 18% overweight, 9% obesity for men and 40% overweight, 14% obesity for women. Zimbabwe's disease terrain, similar to most SSA countries, was until recently dominated by HIV/AIDS (Magodoro et al., 2016). Like any other low-income country in Zimbabwe there is growing recognition of the contribution of chronic diseases to the morbidity and mortality burden in the general population.

Tibaijuka (2005), indicated that since 1980 there has been an explosion of the urban population in Zimbabwe as the country laws were changed to recognize the rights of the black majority. The urban population rose rapidly from 23% in 1982 to almost 40% in 2011 and it has been estimated that urbanisation will continue to increase at an annual rate of 3.4%. Urbanisation and socioeconomic transformation comes with increased access to energy dense foods and less strenuous jobs resulting into many people having a positive energy balance and hence becoming overweight or obese (Popkin, 2014) . With overweight and obesity being proved by research as a major risk factor for chronic health problems, in Zimbabwe the metabolic risk factors for diet related chronic diseases as reported by WHO 2014 indicate 46% of raised blood pressure for adults, 9% raised blood glucose and 24% raised blood cholesterol with high prevalence in all higher in women than in men.

Zimbabwe is undergoing nutrition transition and lifestyle changes. Consequently, the prevalence of overweight, obesity and chronic diseases is increasing rapidly. Many studies have clearly indicated that the prevalence of overweight and obesity is higher in women than in men. There is very limited data on obesity and overweight making it difficult to make informed public health decisions by the Zimbabwean government for it to craft policy and appropriate interventions. The available limited data indicates prevalence of overweight and obesity and chronic diseases risk factors high in women than in men, hence the aim of the study to shed light on the patterns of overweight, obesity, chronic disease risk and physical activity levels of Zimbabwean women; a comparison between rural and urban areas.

The objectives of the study were to: 1) To compare the prevalence of overweight and obesity patterns among urban and rural women in Zimbabwe. 2) To compare chronic disease risk levels among urban and rural women in Zimbabwe. 3) To compare the physical activity levels among urban and rural women in Zimbabwe.

3.3 Methods

All procedures were carried out in Zimbabwe, Bulawayo Province (urban) and Matabeleland North province (rural). Informed consent was obtained from each participant prior to the commencing of data collection. The biomedical ethics committee of University of Kwa-Zulu Natal approved the study (REF: BE380/15; APPENDIX A).

3.3.1 *Study Design and Participant Recruitment*

A descriptive, comparative, and cross sectional design was followed in the study. The sample consisted of (n=140 women) from low density urban residents from Bulawayo Metropolitan Province and (n=140 women) from rural residents from Matabeleland North Province. The sampling procedure was done as follows: The two provinces were conveniently sampled from the ten provinces of Zimbabwe. In Bulawayo Metropolitan Province, a district (Mzilikazi) was randomly selected and then one Ward (27) was also randomly selected from the district. One hundred and forty participants were selected from systematically selected households from the Ward. For Matabeleland North, Hwange District was eliminated from the study as it has two urban settlements. One district (Bubi) was randomly selected from the remaining 6 districts. A ward (20) was randomly selected from the district and finally 140 participants were selected from systematically identified households in the Ward.

3.3.2 *Subject Characteristics*

The selection criteria used to participate in this study specified that: the women should be of the black ethnic group and Zimbabwean. All the women were between the ages of 18- 60 years. The women were residing in Bulawayo Metropolitan province and Matabeleland North province.

Each participant was informed of all procedures associated with participation in the study which included an information sheet explaining on issues on voluntary participation, anonymity, withdrawal and storage of their data before providing written consent which the participants completed before participating in the study. All the procedures of study with the participants were done at their respective homes.

3.3.3 *Data Collection Protocols*

3.3.3.1 Anthropometric Measurements

Anthropometric variables were mass, height, waist girth, hip girth. They were measured according to the standards described by the International Society for the Advancement of Kinanthropometry (ISAK).

Height

Height was measured using a SECA stadiometer (SECA Deutschland Medical scales and measuring systems, Hamburg, Germany). The measurements were taken without shoes and any excess clothing and accessories. A stadiometer measuring to the nearest 0.1cm was used. The subjects stood with feet together with the heels, buttocks and upper part of the back touching the scale, with the head placed in the Frankfort plane. Taking and holding a deep breath, and while keeping the head in the Frankfort plane, with the measurer applying a firm upward lift through the mastoid processes, the reading was then taken to nearest 0.1 cm (Marfell-Jones et al., 2006).

Weight

Weight was measured using a SECA electronic scale (SECA Deutschland Medical scales and measuring systems, Hamburg, Germany).The measurements were taken without shoes and any excess clothing and accessories. A SECA electronic scale measuring to the nearest 0,1kg was used. The subject was barefooted wearing minimal clothing. The scale was checked to make sure it was reading zero. The subject stood on the centre of the scales without support and with the weight distributed evenly on both feet. The reading was then taken to the nearest 0,1kg (Marfell-Jones et al., 2006).

Circumferences/Girths

A standard flexible centimeter-marked tape measure was utilized to measure circumferences (waist, hip) (CESCOF steel tape).

Waist: Waist girth was measured at the level of the narrowest point between the lower costal (10^{th} rib) border and the iliac crest. The subjects assumed a relaxed standing position with the arms folded across the thorax. The subjects' abducts the arms slightly allowing the tape to be passed around the abdomen in front and the tape adjudged to level of the narrowest point (Marfell-Jones et al., 2006).

Hip: The hip girth was measured at the level of the greatest posterior protuberance of the buttocks which usually corresponds anteriorly to about the level of the symphysis pubis. The subjects assumed a relaxed standing position with the arms folded across the thorax. The subjects' feet together and the gluteal muscles relaxed. The tape was passed around the hips from the side and the tape adjudged to level of the greatest protuberance of the buttocks (Marfell-Jones et al., 2006).

3.3.3.2 *Metabolic Risk measurements*

Blood pressure

Blood pressure was measured using the HI-CARE deluxe statoscope Rappaport type and HI-CARE sphygmomanometer. The subjects were in a seated position with the arm flexed and the flexed elbow in the level of the heart. The proper size of the cuff were wrapped around the upper arm pressing the stethoscope's bell over the brachial artery just below the cuff's edge, rapidly inflating the cuff to 180mmHg and releasing air from the cuff at a moderate rate (3mm/sec) and then listening with the stethoscope and simultaneously observing the sphygmomanometer and the recordings were done. The sound heard gives measurement of the systolic pressure and when the sound stops it gives the measurement of the diastolic pressure. Blood pressure measurements were divided into six categories. Optimal <120/80 mmHg, normal 120/80 mmHg, Pre-raised blood pressure 120/80 to 139/89 mmHg, high blood pressure Stage 1 140/90 to 159/99 mmHg, high blood pressure Stage 2 160/100 mmHg and high blood pressure Crisis >180/110

Blood glucose

Blood glucose was measured using Accutrend Plus digital meter GCTL- mmol/l (Roche, Mannheim, Germany). Fasting blood glucose test were used. The test is more definite than a random test because there is no chance that it has been influenced by recent food intake (Mayo Clinic 2016). Blood glucose measurement were divided into: non- diabetic- 3.6 to 5.5mmol/l, pre-raised blood glucose- 5.6 to 6.9mmol/l, and raised blood glucose- 7.0 mmol/l and above (AACC 2014). The meter was coded first with the coding strip that is first inserted in the meter for the coding is done for the particular test strip. The hands were washed and after drying, the finger was cleaned using alcohol swabs. The test strip was inserted into the blood meter. The finger was pricked and a drop of blood was put on a test strip and then the readings were taken after a few seconds. Fasting blood glucose categories, normal 5.6 mmol/l, Pre-raised blood glucose 5.6- 6.9 mmol/l, and raised blood glucose >7 mmol/l

Blood cholesterol

Blood cholesterol was measured using Accutrend Plus digital meter GCTL- mmol/l (Roche, Mannheim, Germany). Blood cholesterol measurements were classified as: > 6.2 mmol/l – high, 5.2- 6.2 mmol/l- borderline high, 3.9- 5.2mmol/l – desirable (Flora Pro-Active Health care Professionals). The meter was coded first with the coding strip that is first inserted in the meter for the coding is done for the particular test strip. The hands were washed and after drying, the finger was cleaned using alcohol swabs. The test was inserted into the blood meter. The finger was pricked and a drop of blood was put on a test strip and then the readings were taken after a few minutes.

3.3.3.3 Questionnaires

Three questionnaires were completed by participants (International Physical Activity Questionnaire, Nutrition and Quality of life). The participants were assisted through explanations where they did not understand in their own language.

International Physical Activity Questionnaire (IPAQ)

The International Physical Activity Questionnaire (IPAQ) is a validated questionnaire primarily designed for the purposes of obtaining internationally comparable data on health-related physical activity among adults (15-69 years). The questionnaire was used to measure the physical activity levels for participants using a duration of 7 days. The questionnaire was self-administered, it is divided into for 5 parts; part 1- Job related, part 2 – Transportation, part 3- Domestic, part 4 – Leisure and part 5- Time spent sitting. The summation of duration (in minutes) and frequency (days) for different domains of physical activity. The Total Metabolic Equivalent (MET) - min/week is the summation of the totals of the four domains (job related, transport, domestic and garden, leisure-time). The Total Metabolic Equivalent –minuets per week were used to determine the overall physical activity levels. The Total MET-min/week were divided into three categories: low - >600 MET-min/week, moderate - < 600 - > 1500 MET-min/week, high - < 1500 MET-min/week.

Quality of Life Questionnaire

The World Health Organisation Quality of Life -Bref questionnaire was designed to assess how an individual feels about their quality of life. The questionnaire produces a profile with four domain scores and two individually scored items about an individual's overall perception of quality of life and health. The four domain scores are scaled in a positive direction with higher

scores indicating higher quality of life. Three items of the questionnaire must be reversed before scoring in the direction of scaling column. The questionnaire was self-administered and it was divided into 5 domains: Domain 1- Physical Health (7-35), Domain 2 –Psychological (6-30), Domain 3 -Social relationship (3-15), and Domain 4 –Environment 8-40). The scores are were then transformed from raw scale to 0-100 scale using the following formula:

$$\textit{Transformed Scale} = \frac{\textit{[Actual raw score – lowest possible raw score]}}{\textit{Possible raw score range}} \textit{ x 100}$$

Nutrition Risk Questionnaire

The questionnaire was self-administered. The questionnaire was concentrating on type of food and the servings' consumption per day. The food nutrients calculated were: energy kilo-calories (kcals), carbohydrates grams (g), proteins grams (g) and fats grams (g). The formula used was:

1 serving of starch = energy (80 kcals), carbohydrates (15 g), proteins (3 g), fat (0-1 g).
1 serving of fruit = energy (60 kcals), carbohydrates (15 g), proteins (0 g), fat (0 g)
1 serving of milk= energy (150 kcals), carbohydrates (12 g), proteins (8 g), fat (8 g)
1 serving of vegetable= energy (25kcals), carbohydrates (5 g), proteins (2 g), fat (0 g)
1 serving meat= energy (75kcals), carbohydrates (0 g), proteins (7 g), fat (5 g)
1 serving butter, oil = energy (45 kcals), carbohydrates (0 g), proteins (0 g), fat (5 g)

Adapted from the U.S Department of Health and Human Services. Applying the Science Nutrition. 2010 Chapter 2 page 32.

The recommended servings used: sedentary women (1600 kcals), active women (2200 kcals), very active women (2800 kcals), (Applying the Science Nutrition. 2010 Chapter 2 page 32).

3.3.4 Statistical Analysis

The anthropometric indices computed were as follows: BMI as weight in kilograms divided by height in meters squared; underweight was defined as BMI <18.5 kg/m^2; overweight was defined as BMI 25 to 29.9 kg/m^2; and obesity was defined as BMI ≥30 kg/m^2 for all subjects. The waist to hip ratio was defined as 0.8 or below – low risk, 0.81 to 0.85 – moderate risk, 0.85+ - high risk. Blood glucose was defined as 4.0-5.9 mmol/l-non diabetic, 4-7mmol/l- raised blood glucose before meals (fasting). Blood pressure was defined as less than 120/80 –normal, 120/80 to 139/89 mmHg pre-high blood pressure, 140/90 to 159/99 mmHg – high blood pressure stage 1, 160/100mmHg – high blood pressure stage 2, and higher than 180/110mmHg hypertensive crises.

Descriptive statistics including means and standard deviations, where applicable and frequencies is represented in tables and graphs. The Chi-square goodness-of-fit-test, a univariate test was used categorical variables to test response options. For the comparison of the independent groups on cases, the independent sample t-test were used and the Chi-square test of independence were used for cross tabulations. The Fisher's exact test was used when the conditions are not met. The SPSS version 22 statistical package was to conduct data analysis.

3.4 Results

A total sample of 280 women participated in the study. Of these, 140 were urban residents and 140 were rural residents. Table 5 shows the descriptive statistics of scale variables for rural and urban women in Zimbabwe.

The number of participants who took part in the study was 140 for rural and 140 for urban. The average age of rural 34.67±10.58 years and of urban 35.67±10.42years, the minimum in both was 18 years and the maximum was 60 years. Both groups had the same average height 1.62±0.05m.The urban women at 71.18 ±15.22kg were heavier than rural 66.58±13.73 women in weight. The BMI for urban women 26.91± 5.20kg/m^2 was higher than rural 25.29±5.14kg/m^2 women and the minimum of urban16.32kg/m^2 and of rural 15.39kg/m^2, maximum for urban 48.10kg/m^2 and 46.52kg/m^2 for rural women. The average waist girth of urban 82.91± 11.92cm and rural 77.91±10.70cm, the minimum for urban 62.00cm, rural 61.00cm and the maximum urban 143.50cm, rural 120.07cm.

The average hip circumference was 103.03± 12.43cm for urban women larger than rural women at 98.79±11.29cm women, minimum 78.00cm for urban, rural 79.00cm and maximum for urban 169.00cm and 138.80cm for rural. The waist to hip ratio was higher in urban 0.80±0.06 than in rural 0.78±0.06, the minimum 0.64 and maximum 1.06 for both groups. Average blood glucose for rural 4.72±1.44 mmol/l and for urban 4.68±1.07 mmol/l. The minimum for rural 1.30mmol/l, urban 2.70mmol/l and maximum for rural 14.00 mmol/l and 8.40 mmol/l for urban. Average blood cholesterol for rural 4.42±0.72 mmol/l and urban 4.17±0.89 mmol/l, minimum 2.40mmol/l for rural, urban 3.10 mmol/l, maximum for rural 6.80 mmol/l, and urban 7.40 mmol/l.

Table 5: Demographic, anthropometric and metabolic risk measurements descriptive statistics of rural (n=140) and urban (n=140) women groups of scale variables in Zimbabwe.

Variable	Group	Mean ± SD	Minimum	Maximum
Age (years)	Rural Urban	34.67±10.58 35.67±10.42	18 18	60 60
Height (m)	Rural Urban	1.62± 0.05 1.62± 0.05	1.50 1.49	1.81 1.78
Weight (kg)	Rural Urban	66.58±13.73 71.18 ±15.22	41.40 40.60	122.10 152.40
BMI (kg/m^2)	Rural Urban	25.29±5.14 26.91± 5.20	15.39 16.32	46.52 48.10
Waist (cm)	Rural Urban	77.91±10.70 82.91± 11.92	61.00 62.00	120.70 143.50
Hip (cm)	Rural Urban	98.79±11.29 103.03± 12.43	79.00 78.00	138.80 169.00
WHR	Rural Urban	0.78±0.68 0.80 ± 0.65	0.64 0.64	1.06 1.06
Blood glucose (mmol/l)	Rural Urban	4.72±1.44 4.68 ± 1.07	1.30 2.70	14.00 8.40
Blood cholesterol (mmol/l)	Rural Urban	4.42±0.72 4.71 ± 0.89	2.40 3.10	6.80 7.40

Table 6 shows the descriptive statistics on questionnaires. The average physical activity work domain of rural 2119.30±5229.19 MET-min/week and of urban 3000± 4511 MET-min/week, the maximum for rural 38556.00 MET-min/week and urban 28500.00 MET-min/week. The transport domain average for rural 1417.01±1583.42 MET-min/week and urban 1058.96±1404.43 MET-min/week. The domestic domain urban women 3348.23±3259.68 MET-min/week, rural 4865.88±4718.98 MET-min/week. The leisure domain for urban 895.47±2180.12 MET-min/week, rural 427.51±886.66 MET-min/week, the maximum for urban 19998.00 and 6792.00 for rural women. The average total MET-min/week of urban 8302.99±7798.37 and rural 8826.66±7739.30, the minimum for urban 210, rural 210 and the maximum urban 55488.00 MET-min/week, rural 42504.00 MET-min/week. The average physical health domain was 68.67± 15.50 for urban, rural 68.67± 15.50, minimum 68.67± 15.50 for urban, rural 7.14 and maximum for urban 100.00 and 100.00 for rural. Average psychological domain in urban 65.53±11.63%, rural 65.14±13.35%, the minimum 25 and maximum 91.27 for both groups. Average social domain for rural 67.97±18.11% and for urban 71.30±17.40%, minimum for rural 16.67%, urban 0 and

maximum for rural 100.00% and 100.00% for urban. Average environment domain for rural 56.32±13.28% and urban 53.73±14.53%, minimum 21.88% for rural, urban 9.38%, maximum for rural 87.50%, and urban 90.63%.

Table 6: Descriptive statistics on questionnaires of rural (n=140) and urban (n=140) women groups of scale variables in Zimbabwe**.**

Variable	Group	Mean±SD	Minimum	Maximum
IPAQ Work (MET-min/week)	Rural Urban	2119.30±5229.19 3000± 4511	.00 .00	38556.00 28500.00
IPAQ Transport (MET-min/week)	Rural Urban	1417.01±1583.42 1058.96±1404.43	.00 .00	8208.00 8316.00
IPAQ Domestic (MET-min/week)	Rural Urban	4865.88±4718.98 3348.23±3259.68	210 90	27720.00 26520.00
IPAQ Leisure (MET-min/week)	Rural Urban	427.51±886.66 895.47±2180.12	.00 .00	6792.00 19998.00
IPAQ Total (MET-min/week)	Rural Urban	8826.66±7739.30 8302.99±7798.37	210 210	42504.00 55488.00
QOL Physical (%)	Rural Urban	70.57±16.71 68.67± 15.50	7.14 17.86	100.00 100.00
QOL Psychology (%)	Rural Urban	65.14±13.35 65.53±11.63	25.00 25.00	91.27 91.27
QOL Social (%)	Rural Urban	67.97±18.11 71.30±17.40	16.67 .00	100.00 100.00
QOL Environment (%)	Rural Urban	56.32±13.28 53.73±14.53	21.88 9.38	87.50 90.63
NRQ Energy (kcals)	Rural Urban	2020.42±292.90 2187.73± 242.93	1248 1718	2955 3184
NRQ Carbohydrates (g)	Rural Urban	252.53±28.53 256.92±30.97	180 206	372 414
NRQ Proteins (g)	Rural Urban	86.87±15.03 91.73± 14.73	43 55	138 138
NRQ Fats (g)	Rural Urban	52.44±16.34 62.99± 13.64	5 33	93 108

The average energy consumption was 2020.42±292.90 kcals for urban, rural 2020.42±292.90 kcals, minimum 1718 kcals for urban, rural 1248 kcals and maximum for urban 3184 and 2955 kcals for rural. Average carbohydrates in urban 256.92±30.97g, rural 252.53±28.53g, the

minimum 180g for rural, 206g urban and maximum 372g for rural, 414g for urban. Average protein for rural 86.87±15.03g and for urban 91.73± 14.73g, minimum for rural 43g, urban 55g and maximum for rural 138g and 138g for urban. Average fats for rural 52.44±16.34g and urban 62.99± 13.64g, minimum 5g for rural, urban 33g, maximum for rural 93g, and urban 108g.

3.4.1 *Anthropometric Measurements*

The average age of urban and rural women was 35.68±10.43 years and 34.67±10.88 years respectively. The average height for the rural women was the same as that of the urban women (1.62±0.05m). The urban women had an average weight of 77.18±15.22kg, while the rural women presented an average of 66.58±13.73kg. The average BMI for urban women was 26.91±5.20kg/m^2 and for the rural women 25.29±5.14kg/m^2. The urban women had an average of 82.99±11.92cm while the rural women had 77.91±10.70cm for the waist circumference. The average for the Waist to hip ratio (WHR) for urban women was 0.80±0.06 and for rural women 0.78±0.06. Refer to Table 7 for linkage.

Table 7: Rural and Urban groups in Zimbabwe for anthropometric variables independent tests

Variable	**Rural (Mean±SD)**	**Urban (Mean±SD)**	**F**	**P-Value**
Height (m)	1.62± 0.05	1.62± 0.05	1.798	0.739
Weight (kg)	66.58±13.73	71.18 ±15.22	0.700	0.008*
BMI (kg/m^2)	25.29±5.14	26.91± 5.20	0.071	0.009*
Waist (cm)	77.91± 10.70	26.91± 5.20	1.770	0.0005*
Hip (cm)	98.79±11.29	103.03± 12.43	0.026	0.003*
WHR	0.78 ± 0.06	0.80 ± 0.06	2.091	0.041*

*significance $p < 0.05$

Weight (Figure 3) had a significant difference between urban and rural women (p=0.008) Urban women were heavier than rural women, average weight of 71.19 ±15.23kg versus 66.58±13.73kg, t (278) =-2.657, p<0.008.

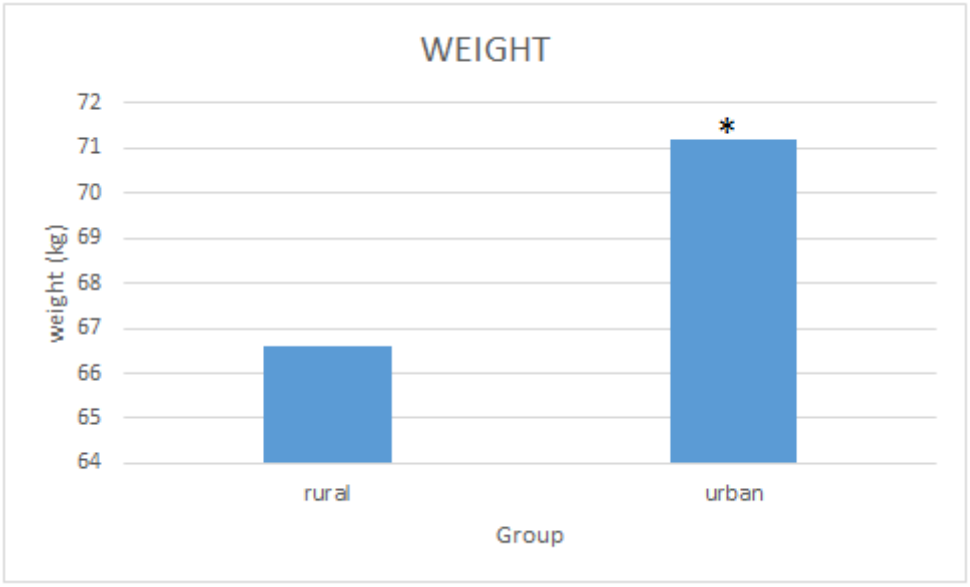

Figure 3: Weight (kg) for the rural and urban groups

*significance (p=0.008) with urban group (M=71.18kg) being heavier in weight than rural group (M=66.58kg)

There was a significant relationship indicated between BMI (Figure 4) and location (rural and urban) women. Urban women had a higher BMI compared to rural women, t (278) =-2.615, p= .009.

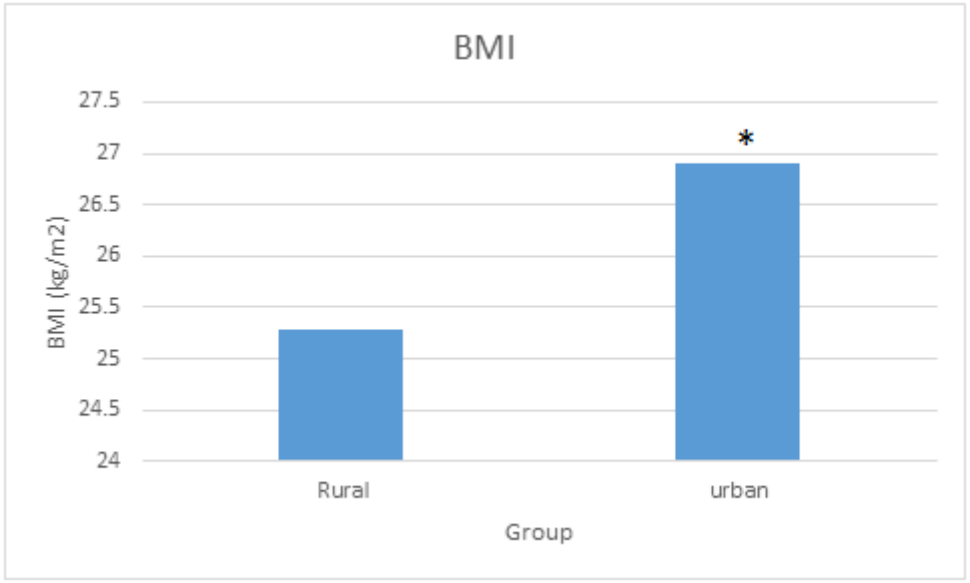

Figure 4: BMI ($kg/m^{2)}$ for the rural and urban groups

*significance (p=0.009) with urban group (M=26.91kg/m^2) having a high BMI than rural group (M=25.29kg/m^2)

When considering BMI classification a significant number of the total sample are either normal (117) or overweight (96), χ^2 (4) =181.500, p<0.0005. Significantly fewer are extremely obese (3) or underweight (11). Between BMI classification and location there were no significant differences found. Looking at obesity stage classification, a significant number were not in the obese category (224), χ^2 (3) = 465.743, p<0.0005. Significantly fewer than expected are in stage 2 and stage 3 categories.

Significant differences are shown in average age within the BMI categories (Welch (4, 13.701) = 6.940, p=0.003). Specifically, average age is higher for obese subjects than for normal or overweight subjects for the whole sample. Within the BMI categories for the urban sample, significant differences are shown in average age (F (4.135) =4.649, p=0.002). Specifically, average age is higher in obese BMI subjects than in normal BMI subjects in the urban area. With the rural sample there were no significant differences within the BMI categories. The sample indicated mean waist circumference was 82.99 ±11.92cm and 77.91± 10.70cm in urban and rural women respectively, there was a significant difference between location and waist circumference p<0.0005. The study showed a significant difference in hip circumference between urban and rural women, t (278) = -2.978, p=0.003, (Figure 5).

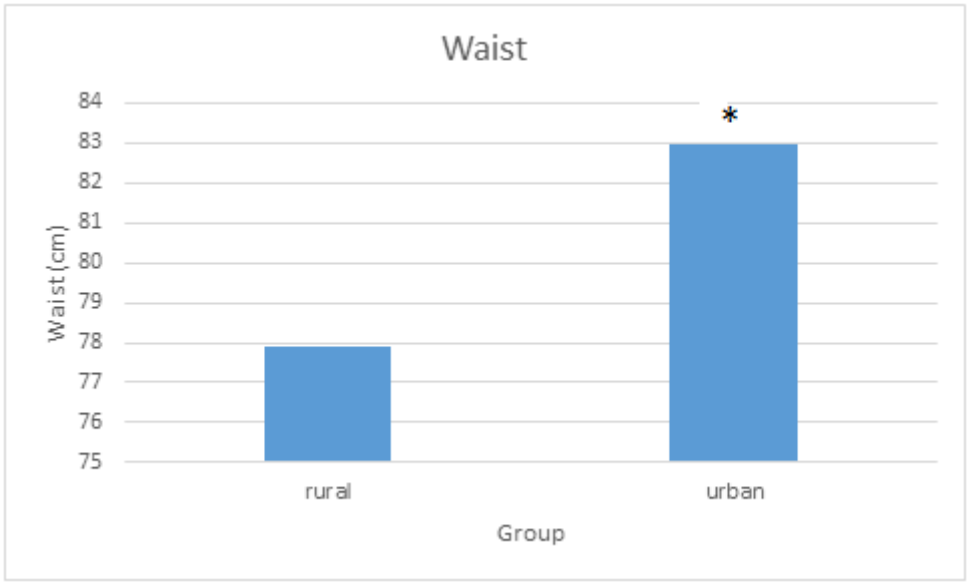

Figure 5: Waist circumference (cm) for the rural and urban groups

*significance (p<0.0005) with urban group (M=82.99cm) having a higher waist circumference than rural group (M=77.91cm).

The average Waist to Hip Ratio of 0.80 ±0.60 for urban women and 0.78 ±0.68 for rural women. There was a significant difference in location and waist to hip ratio, t (278) = -2.005, p= 0.041, urban women showed a higher WHR as compared to the rural.

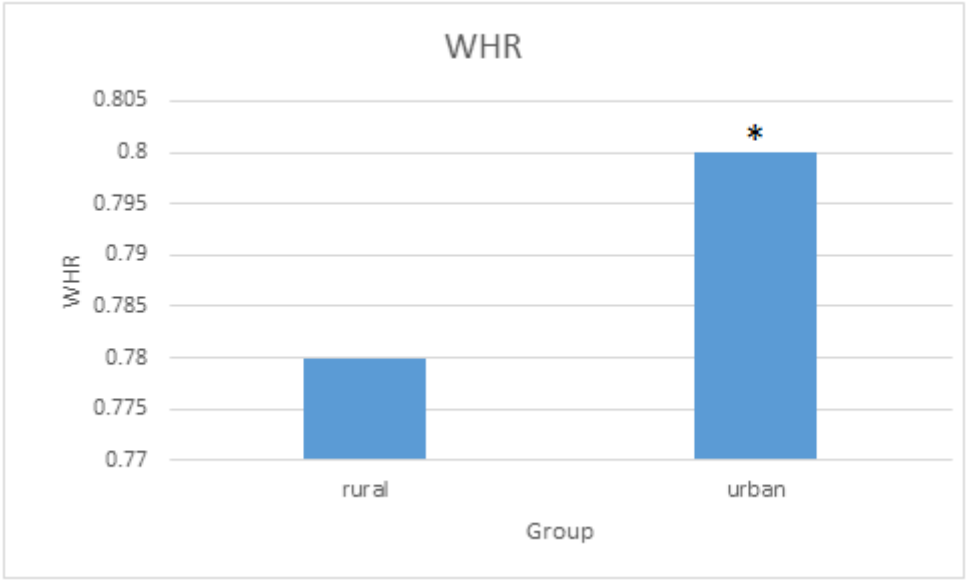

Figure 6: Waist to hip ratio (cm) for the rural and urban groups.

*significance (p=0.041) with urban group (M=0.80) having a higher Waist to hip ratio than rural group (M=0.78).

In the rural sample age has shown to be significantly positively correlated with; height (r =0.257, p<0.002); waist (r =0.213, p<0.011); WHR (r =0.178, p<0.035) while in the urban sample it was significantly positively correlated with; height (r =0.305, p<0.0005); weight (r = 0.453, p<0.0005); BMI (r = 0.394, p<0.0005); waist (r =0.498, p<0.0005); WHR (r =0.225, p<0.008).

Disease Risk

When considering the disease risk classification, a significant number are at no risk (128) or increased risk (79), χ^2 (4) =170.821, p<0.0005 for the whole sample. Significantly fewer than expected are at high risk and extremely high risk. Considering BMI disease risk as shown in rural area 76 (54.3%) are not at risk, 39 (27.9%) are at increased risk, 9 (6.4%) high, 15 (10.7%) very high, 1 (0.7%) extremely high. Urban area 52 (37.1%) are not at risk, 40 (28.6%) are at increased risk, 17 (12.1%) high, 29 (20.7%) very high and 2 (1.4%) extremely high. There is a significant relationship between disease risk and location, χ^2 (4) = 11.762, p=0.019 (Figure 4). More than expected from rural areas are not at risk; and from urban areas are at high or very high risk. There is a significant relationship between age and obesity stage (p< 0.05). More than expected 40-49

year olds are classified as stage II or III; and 50-60 year olds as stage 1. A significant relationship between age and disease risk ($p < 0.05$) was noted. More than expected 18-29 year olds were classified as at no risk; 30-39 year olds as increased or high risk; 40-49 year olds as very high or extremely high; and 50-60 year olds as very high. . Obesity stage categories showed significant differences in average age ($F(3, 276) = 6.427$, $p<0.0005$. Specifically average age is higher in stage 3 obese participants than in participants who were not obese. In the urban sample significant differences were shown ($F(3, 136) = 4.862$, $p=0.003$, specifically average age is higher in stage 2 obesity subjects than in not obese subjects

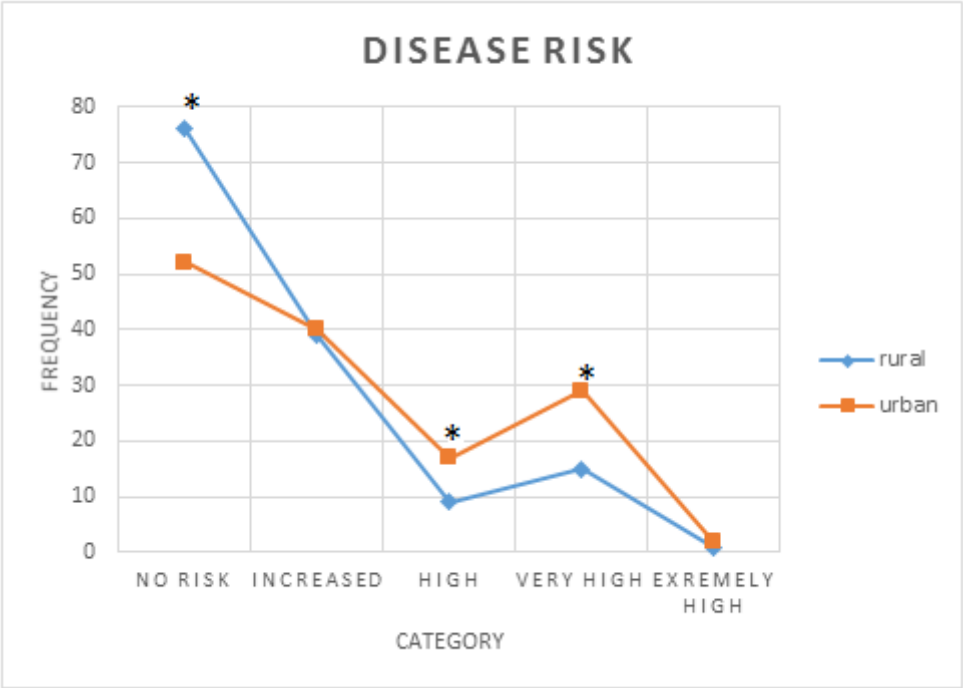

Figure 7: Disease risk categories presenting the relationship for the rural and urban groups. The vertical axis indicate the frequency of participants in each category (horizontal axis) for both groups which was used to for comparison.

*significance, where $p\leq0.05$, more than expected in the rural group were at no risk, while in the urban group more were at high and very high risk ($p=0.019$).

When considering the WHR disease risk classification, a significant number are at low risk (162) $\chi^2(2) = 80.600$, $p<0.0005$. Significantly less than expected are at high risk. Looking at the average age of the whole sample and disease risk there was a significant difference within categories ($4, 15.203) = 7.664$, $p =0.001$. Specifically average age is higher in very high risk subjects than on no risk and increased risk subjects. In terms of location, in the urban sample significant differences are shown in average age with disease risk ($F(4, 135) = 4.868$, $p=0.001$, specifically average age

is higher in very high risk category than on risk category subjects. Average age with the WHR categories a significant difference was indicted (F (2, 277) = 4.555, p=0.011, average age is higher in high risk subjects than low risk subjects.

3.4.2 *Metabolic Risk Measurements*

Blood Pressure

Considering the blood pressure classification, in the urban sample a high number of 51 were in the optimal category 36.4%, normal 28.6%, pre-high blood pressure 22.1%, high blood pressure stage 1- 12.1%, high blood pressure stage 2- 0.7%. The rural sample had 46.4% on the optimal category, 25.7% in the normal 13.6% pre-high blood pressure, 12.1% hyper tension stage 1, 3.6% high blood pressure stage 2, and 2.9% high blood pressure crisis.

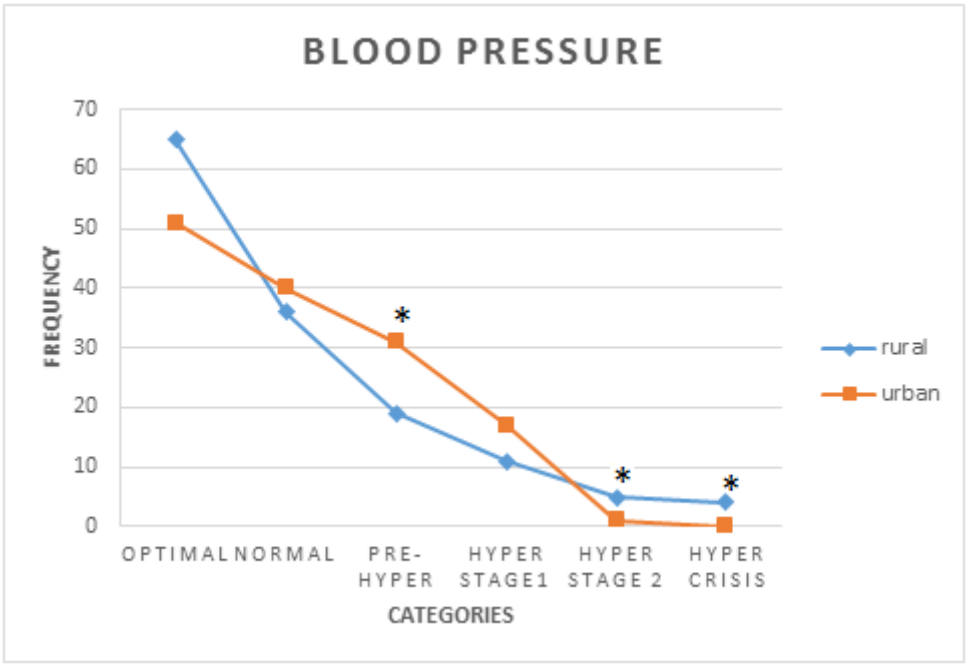

Figure 8: Blood pressure categories presenting the relationship for the rural and urban groups. The vertical axis indicate the frequency of participants in each category (horizontal axis) for both groups which was used to for comparison.

*significance, where p≤0.05, more than expected in the urban group were pre-hypertensive, while in the rural group more were in high blood pressure stage 2 and high blood pressure crisis (p=0.025).

There is a significant relationship between location and blood pressure, p=0.025. More than expected of the rural respondents are at high blood pressure stage 2 or hypertensive crisis stage; while more than expected of the urban respondents are pre-hypertensive. Significant differences are shown in average age within the BP categories in the rural sample p=0.011, specifically

average age is higher in high blood pressure stage 1 than optimal subjects. In the urban sample significant differences are shown ($F (4, 135) = 9.317$, $p<0.0005$. Average age is higher in high blood pressure stage 1 than in optimal and pre-high blood pressure; higher in pre-high blood pressure and high blood pressure stage 1 than in normal. More than expected 18-29 year olds were classified as optimal; 40-49 year olds as hypertensive crisis; and 50-60 year olds as high blood pressure stage 1 and high blood pressure stage 2 ($p < 0.05$).

Blood Glucose

The mean for blood glucose in rural sample was 4.72±1.44mmol/l, urban women had an average of 4.68 ± 1.07mmol/l. The minimum was 1.30mmol/l, maximum was 14.00mmol/l and mode was 3.80mmol/l in the rural sample. The urban cohort had a minimum of 2.70mmolL, maximum of 8.40mmol/l, and the mode was 3.80mmol/l. There was no significant difference shown in the study between location and blood glucose. In terms of age and blood glucose there was a significant positive correlation ($r = 0.230$, $p<.0005$). In the rural sample there was a significant positive correlation between age and blood glucose ($r =0.214$, $p =.012$), and for urban sample ($r = 0.259$, $p = 0.002$). There was a significant difference across age groups for blood glucose levels $p=0.013$).

Blood Cholesterol

Blood cholesterol tests showed an average of 4.57 mmol/l ± 0.83). Average of (4.72mmol/l ± 0.89) for urban area was significantly higher than (4.42mmol/l ± 0.78) for rural area, $t (260.480) = -2.982$, $p= 0.003$ (Figures 6). Age was significantly positively correlated with blood cholesterol ($r =0.340$, $p<0.0005$). In the rural sample a significant positive correlation was shown between age blood cholesterol ($r =0.267$, $p =0.002$) and urban sample shows a significant positive correlation ($r = 0.395$, $p <0.0005$).

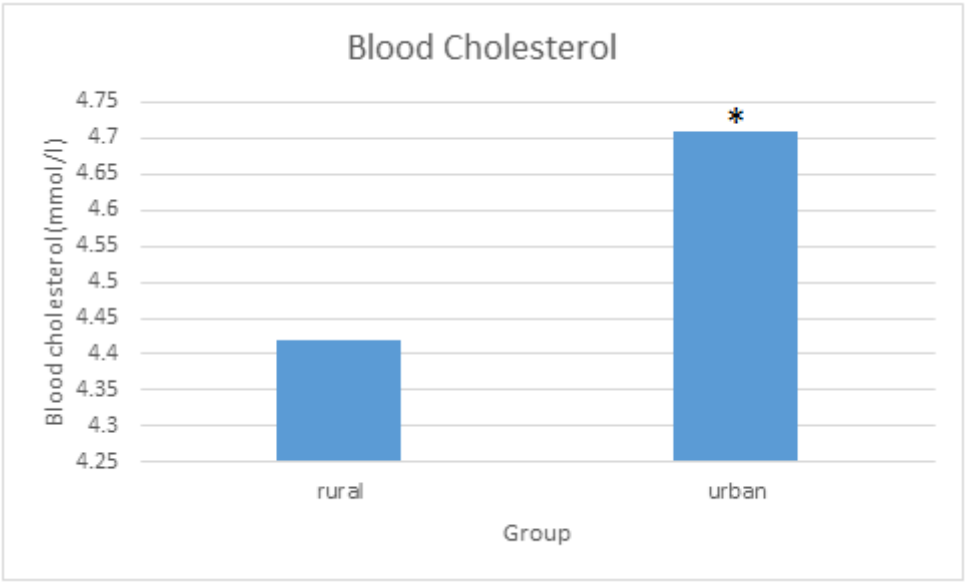

Figure 9: Blood cholesterol (mmol/l) for the rural and urban groups.

*significance (p=0.003) with the urban group (M=4.71mmol/l) having a higher blood cholesterol level than the rural group (M=4.42).

In terms of age a significant difference across age groups of cholesterol was indicated; levels (F (3, 267) = 10.297, p<0.0005), 40-49 year olds have higher levels than 18-29 year olds; and 50-60 year olds have higher levels than 18-39 year olds.

3.4.3 *Questionnaires*

International Physical Activity Questionnaire (IPAQ)

Table 8: Rural and Urban groups in Zimbabwe for Physical activity levels independent tests. The units (MET-min/week).

Variable	Rural (Mean±SD)	Urban (Mean±SD)	F	P-Value
IPAQ Work	2119.30±5229.19	3000± 4511	0.746	0.135
IPAQ Transport	1417.01±1583.42	1058.96±1404.43	1.574	0.046*
IPAQ Domestic	4865.88±4718.98	3348.23±3259.68	11.409	0.002*
IPAQ Leisure	427.51 ± 886.66	895.47±2180.12	12.586	0.020*
IPAQ Total	8826.66±7739.30	8302.99±7798.37	0.170	0.573

*significance $p < 0.05$

Most women presented an overall of high physical activity levels in the four analysed physical activity domains 78.6% (work, active transport, domestic and garden, leisure time). Among the four PA domains high PA levels were presented in the domestic and garden and low PA levels were in the leisure time domain. The average Total MET-min/week for urban women (8302.99± 7798.37) and for rural women (8826.66±7739.30).The rural women presented high levels of PA levels (79.3%) than urban women (77.9%), moderate PA levels was 20.0% for rural and 19.3% for urban. Low PA levels for rural and urban sample in this study was 0.7% and 2.9% respectively (Figure 10).

There was a significant difference between urban women and rural women in PA levels in the transport, domestic and leisure domains. In the transport domain in rural area an average of (1417.0121 MET-min/week) was significantly higher as of those in urban area (1058.96 MET-min/week), t (287) = 2.002, p = 0.046. Domestic domain had an average of (4865.88 MET-min/week) compared to urban with an average of (3348.23 MET-min/week) t (247.048) = 3.131, p =0.002. In the leisure domain in urban women an average of (895.47±2180.12MET-min/week) was significantly higher compared to rural women (427.51 ± 886.66 MET-min/week), t (184.028) = -2.351, p=0.020. Age was significantly negatively correlated with leisure domain in the rural sample (M=427±886.66, r = -0.169, p = 0.047). In urban sample age was significantly positively correlated to job related domain (M=3000±4511 MET-min/week, r = 0.208, p = 0.014).

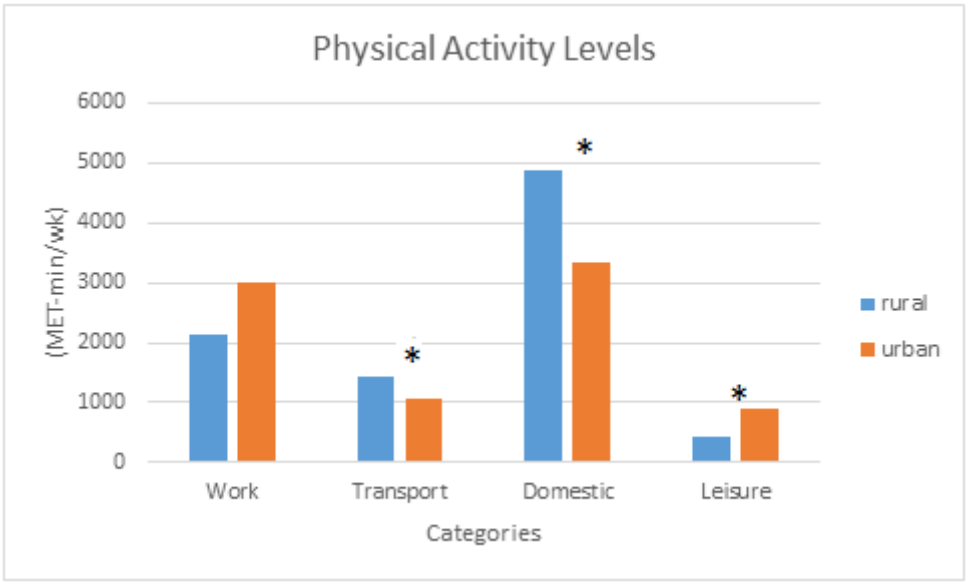

Figure 10: Physical activity levels divided into categories; work, transport, domestic and leisure for rural and urban groups.

*significance (p<0.05), transport p=0.046, domestic p=0.002, leisure p=0.020.

There was no significant difference between the rural and urban women between their physical activity Total MET-min/week.

Quality of Life

Table 9: Rural and Urban groups in Zimbabwe for Quality of life independent tests. The units (%)

Variable	**Rural (Mean±SD)**	**Urban (Mean±SD)**	**F**	**P-Value**
QOL Physical	70.57±16.71	68.67± 15.50	0.217	0.323
QOL Psychology	65.14 ± 13.35	65.53±11.63	1.629	0.797
QOL Social	67.97±18.11	71.30±17.40	1.304	0.118
QOL Environment	53.32 ± 13.28	53.73±14.53	0.756	0.809

significance $p < 0.05$

The quality of life questionnaire was presented in 4 domains (physical health, psychological, social, and environmental). Overall presentation of quality of life in the study population showed high quality of life results with an average of (PH 69.62% ± 16.11, Psych 65.34% ± 12.50, Social 69.64% ± 17.80, Environmental (53.52% ± 13.90). Urban women presented high quality of life in the social domain than rural women 71.30% ± 17.40 versus 67.97% ±18.11 respectively. In PH domain the rural sample presented high quality of life levels than urban sample 70.57% ± 16.71 versus 68.67% ± 15.50 respectively. From the domains the Environmental domain had a low presentation in both rural and urban sample compared to the other domains. In the rural sample there was a significant negative correlation between age and QoL- physical ($r = -0.278$, $p < 0.0005$) as well as between age and QoL-psychological ($r = -0.141$, $p = 0.018$). Urban sample showed a significant negative correlation between age and QoL- physical ($r = -0.262$, $p = 0.001$).

Nutritional risk Questionnaire

Table 10: Rural and Urban groups in Zimbabwe for Nutritional consumption independent tests

Variable	**Rural (Mean±SD)**	**Urban (Mean±SD)**	**F**	**P-Value**
NRQ Energy (kcals)	2020.42±292.90	2187.73± 242.93	2.180	<0.0005*
NRQ Carbohydrates (g)	252.53±28.53	256.92±30.97	0.493	0.218
NRQ Proteins (g)	86.87±15.03	91.73± 14.73	0.115	0.007*
NRQ Fats (g)	52.44±16.34	62.99± 13.64	2.246	0.0005*

*significance $p < 0.05$

Four categories were presented in the nutrition questionnaire (energy (kcals), carbohydrates (g), proteins (g), and fats (g) consumption per day. An average of 2187.73 kcals per day was presented

for urban women and 2020.42 kcals per day for rural women. A significant relationship between energy consumption and location was indicated, t (278) = -5.202, p<0.0005. In the urban sample age was significantly positively correlated with; energy consumption (r =0.307, p<0.0005) (Figure 8).

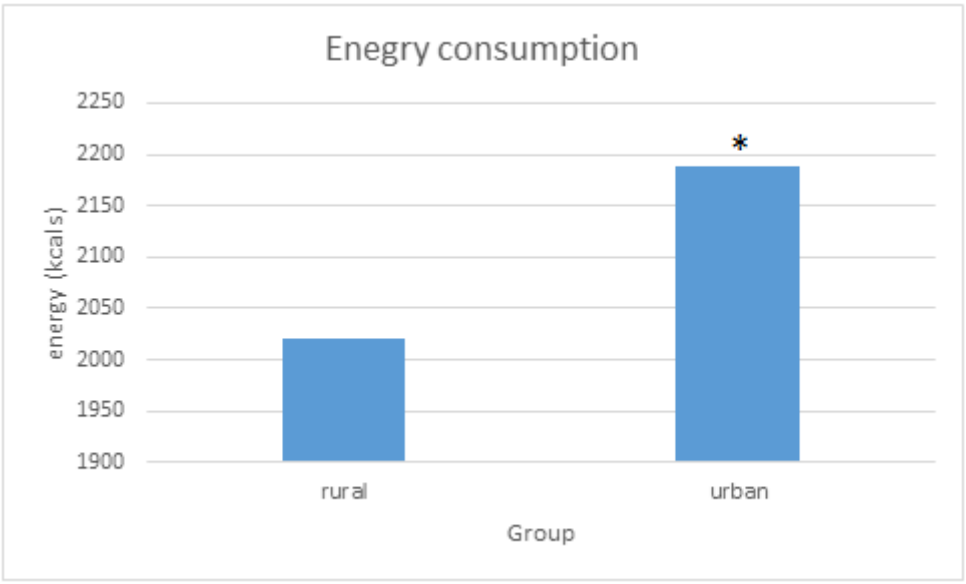

Figure 11: Energy consumption (kcals) for the rural and urban groups.

*significance (p<0.0005) with the urban group (M=2187.73kcals) having a higher energy consumption levels than the rural group (M=2020.53kcals).

Consumption of carbohydrates, proteins and fats was higher in urban than rural areas in this study (Figure 9). An average protein consumption of people in urban area (M=91.73 ±14.731g) is significantly higher than that of rural area (M= 86.87 ±15.037g), t (278) = -2.730, p= 0.007. Urban women had an average of (M=62.99±13.644 g) on fats consumption compared to rural women (M=52.44 ±16.342 g), t (278) = -5.864, p <0.0005. In the rural sample unlike the urban sample there was no significant relationship between age and nutrition.

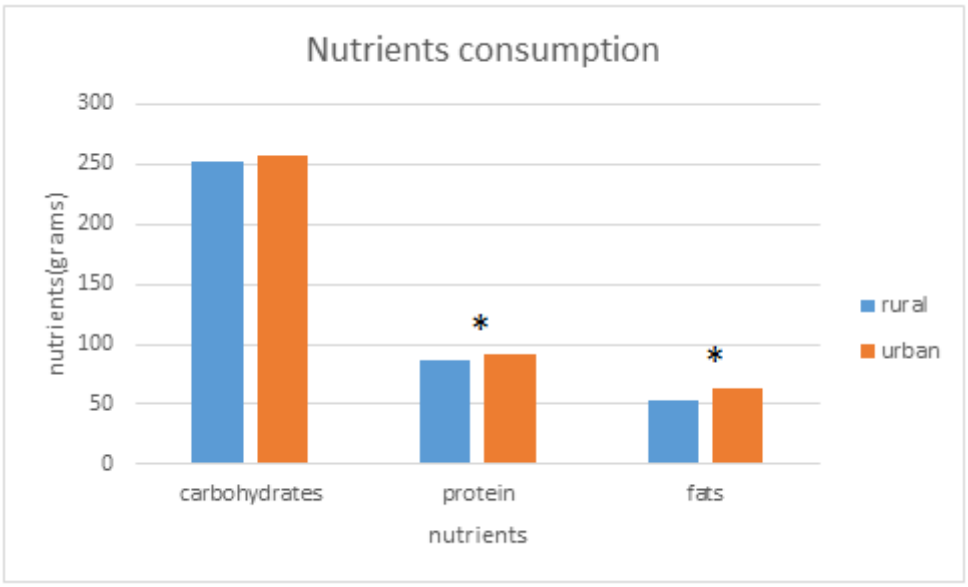

Figure 12: Nutrients consumption (grams) divided in three groups; carbohydrates, protein and fats for the rural and urban groups.

*significance ($p<0.05$), protein $p=0.007$, and fats $p<0.0005$, with the urban group having a higher protein and fat consumption than the rural group.

3.5 Discussion

The aim of the study was to compare weight, chronic disease risks and physical activity levels of women in Zimbabwean between rural and urban communities.

The study indicated an average age of 35.17±10.49years and an average height of 1.62±0.05m, for the urban and rural sample respectively. There was no significant difference found between locations. The results from the study show that there is a considerable proportion of overweight and obesity (BMI > 25kg/m^2) among the study sample. An average BMI of the sample in the urban area (26.90±5.20kg/m^2) was slightly higher than in rural area (25.29± 5.23kg/m^2). There was significant relationship between weight and location, t (278) =-2.657, $p<0.008$, with urban women indicating to be heavier than rural women (71.19 ±15.23kg vs 66.58±13.73kg) respectively.

The results are in agreement with most studies that there is an increase in the prevalence of overweight and obesity in women in developing countries. The results are worrying as the increase in overweight and obesity result in increased chronic diseases risk factors for the populations which like Zimbabwe still have a burden of communicable diseases.

The urban women indicated a high BMI than rural women and this can be a result of urbanisation and change of lifestyle going on in urban areas. Contrary to urban area in rural areas the lifestyle is still the traditional one composed of high physical activity and traditional nutrition (high fibre and low sugar diets). In a similar study done in Zimbabwe 2010 by Mathe and Brodie, the results showed that there was no mean values indicating underweight (BMI<18.5kg/m^2)in any of the populations measured, the men and women from Harare low density results showed that they were overweight (BMI>25kg/m^2). In a study done in Tanzania, the prevalence of overweight was highest in urban Dares Salaam than rural Handeni and Monduli (Njelekela et al., 2002)In a study in Seychelles, the results showed overall participants were underweight (3.5%), normal weight (33.4%), and overweight (35.3%) and obese was (27.9%) (Alwan et al., 2010).

The prevalence of overweight and obesity was slightly higher in urban women than rural women, similar to a study in Mozambique where the results showed the prevalence of overweight individuals as 30.1% and 10.2% for urban and rural areas respectively (Silva-Matos et al., 2011). In a survey done by Christensen et al. (2008), among rural and urban residents in Kenya, found more than a 2-3 fold difference in percent overweight (approximately 40% versus 16%) obesity (approximately 16% versus 5%) among urban and rural residents respectively. A study in South Africa had similar findings that the prevalence of overweight and obesity was higher in urban than in rural areas (Cois and Day, 2015).

The average BMI of the rural women was 25.29± 5.23kg/m^2, categorizing them as overweight. This could mean that their lifestyle maybe changing and becoming similar to urban lifestyle (high consumption of processed foods) due to movement between urban and rural areas. Peer et al. (2014), indicated that due to frequent population flows between urban and rural areas, lifestyle habits maybe changing with uptake of unhealthier diets and sedentary lifestyles that contribute to obesity occurring even in rural sub-Saharan African settings.

In terms of BMI and age the study findings show a significant relationship between age and BMI ($p< 0.05$) for the whole sample. More than expected 18-29 year olds were classified as normal; 30-39 year olds as overweight; 40-49 year olds as obese or extremely obese; and 50-60 year olds as underweight. In the urban sample a significant relationship was indicated between age and BMI ($p<0.0005$). Urban women due to the ongoing urbanisation and subsequent lifestyle changes have become more exposed to sedentary behaviors. Menopause could be another influencing factor for the 40-49 years being classified as obese or extremely obese. Menopause is part of life in women. It is brought on by a decrease in the production of hormones, such as estrogen (Ouzounian and Christin-Maitre, 2005).With menopause come various metabolic changes that can directly affect weight gain (de Moura et al., 2012).

In a study done in Nigeria Akarolo-Anthony et al. (2014), they found that the individuals who were older than 30 years were more likely to be overweight or obese than young persons (<30 years). Similar findings were found in a longitudinal study done by Doku et al. (2012),on Ghanaian women aged 15-49 years, overweight and obesity was highly prevalent (21.8%, 14.8%) among the older age group (40-44 years) while the lowest (1.4%) was among the youngest age group (15-19 years). In study done in Tanzania findings showed that 24.1% were overweight and 19.2 % were obese and obesity prevalence was highest (31.9%) in age group 45-54 years. It has been shown that obesity increases with age. The association can be explained in part, by a decrease in the degree of physical activity with age in both men and women, with another explanation particularly in women being a decrease in metabolism with age after menopause (de Moura et al., 2012). The health delivery system needs to address the issue of chronic diseases as the findings indicates high risk especially among old age.

A significant difference in WC between urban and rural women $p<0.0005$. The study showed a significant difference in hip circumference between urban and rural women, $t(278) = -2.978$, $p=0.003$. The average Weight –Hip Ratio of 0.80 ±0.60 for urban women and 0.78 ±0.68 for rural women, a significant relationship between was indicated $p=0.041$. Urban sample had higher central obesity compared to rural sample. Mathe and Brodie (2010), indicated that the urban women of Harare had a WC indicating an increased risk of CVDs (WC>80cm). Abdominal obesity or increased WHR puts one at particularly high risk for CVDs. In a study done on women in Mozambique showed that the average WC for urban women was significantly higher than in rural women (Gomes, et al., 2010).

In the study it was noted that there is a significant relationship between age and WHR ($p = 0.039$). In the rural sample there was a significant relationship between age, WC and WHR ($r =0.213$, $p=.011$, $r =0.178$, $p=0.035$). In the urban sample a significant relationship was noted as well between age, WC and WHR ($r =0.498$, $p<0.0005$, $r =0.225$, $p=0.0008$). High WC in both groups indicate an increased risk to non-communicable diseases for older women. There seems to be an increase in WC with increasing age, which, in our opinion could be associated with parity mostly with women in the country. A study in Benin, Ntandou et al. (2009), found that abdominal obesity was positively associated with increased probability of metabolic syndrome. Abdominal obesity proved to be an important risk factor for heart failure among adults in Congo, where adults with increased waist-to-hip ratios had increased risk of heart failure, (Longo-Mbenza et al., 2007).

According to Huxley et al. (2010), growing evidence suggests that a central (abdominal) fat distribution pattern, as reflected by a higher WC or WHR might be a better measure of classifying risk levels of chronic illness. In this study urban sample indicated a higher measure of WC and

WHR compared to rural sample (82.99±11.92cm and 0.80±0.60, 77.91±10.70cm and 0.78±0.68) respectively, basing on WC and WHR there are at increased risk of developing various illnesses, a significant difference between location and WC was noted p=0.000. The results in the study show increased disease risk among the sample, 28.2% are at increased risk, and 15.7% at very high risk. A significant difference on disease risk was present, urban women were at high risk or very higher risk compared to rural women who were more not at risk $\chi^2(4) = 11.762$, p=0.019. Longitudinal studies show that the correlation between obesity and fatal CVDs is the strongest in women with very high intra-abdominal fat, (Fogelholm, 2010). In the study disease risk in terms of WHR is more prevalent in urban population, a higher WC was indicated in urban area compared to rural area. A significant relationship between age and disease risk ($p < 0.05$). Older women in both urban and rural were at higher disease risk compared to younger women and more at risk were urban women due to exposure to physical inactivity.

Raised blood pressure is the most common CVD risk factor worldwide, and one of the most important preventable risk factor for premature death (Mendis et al., 2007). In this study the sample indicated a considerable prevalence of raised blood pressure (17.9% pre-hypertensive, 10.0% raised blood pressure stage 1). Findings show a significant relationship between location and blood pressure p=0.025. This result was unexpected as more than expected of the rural respondents are at raised blood pressure stage 2 or hypertensive crisis stage; while more than expected of the urban respondents are pre-hypertensive. Most studies found high prevalence of overweight and obesity among women to be associated with increased risk of raised blood pressure (South Africa Demographic Health Survey, 2002).

In a study done in Zimbabwe, Mazoe District by Mungati et al. (2014), indicated that obesity was associated with raised blood pressure p<0.001, with obese patients being 4.15 times more likely to be hypertensive than non-obese patients. Tesfaye et al. (2007) the study done on Indonesian adults found a 25%% prevalence of raised blood pressure among women and 24% in men. In a study done by (Eric et al., 2015) in South Africa Limpopo Province, the results showed that obesity was found to be associated with raised blood pressure, similar with the finding observed elsewhere in South Africa and India, Thankappan et al. (2010).

In our study a significant relationship between age and BP ($p < 0.05$) was noted. The prevalence of raised blood pressure increased with age, 40-49 year olds mostly were in the hypertensive crisis category; and 50-60 year olds fell in the raised blood pressure stage 1 and raised blood pressure stage 2 categories compared to 18-29 year olds who most were in the optimal category. In a study done in South Africa by Mkhonto et al. (2012), results showed that raised blood pressure was

significantly high among women (38.1%) than men (21.9%) and raised blood pressure increased with increasing BMI, WC and WHR in both women and men. Gomes (António Gomes et al., 2013) in a study in Mozambique found that the women with higher BMI and abdominal obesity had high prevalence of raised blood pressure and that in women the prevalence of raised blood pressure increased with the frequency in alcohol consumption.

Findings in the study show that most of the subjects fall in the normal range in terms of raised blood glucose mellitus results. There is no significant difference among urban and rural women in the study. An average of (4.68 ± 1.07mmol/l) urban area and (4.72 ± 1.44mmol/l) in rural area were found, with these results it can be said that more participants were non-diabetic. The results showed a significant positive correlation between blood glucose and age (M=4.70 ±1.27, r =0.235, p<0.0005), in urban women (M=4.72±1.44, r =0.259, p=0.002) and rural women (M=4.68±1.07, r =0.214, p=0.012). In Africa the highest prevalence rates have been reported for the island of Reunion (15.4%), followed by Seychelles (12.1%), Gabon (10%) and Zimbabwe (9.7%) (Mbanya et al., 2015).

With Zimbabwe rated as one of highest countries for raised blood glucose prevalence, in the study sample results did not show any prevalence of raised blood glucose. Different findings to the study were noted in a systematic review done on raised blood glucose in sub-Saharan Africa 1999-2011 by (Hallal et al., 2012), a very high prevalence (>10%) of raised blood glucose was recorded in Zimbabwe and low to medium prevalence (0-7%) recorded in Cameroon, Guinea, Ghana, Kenya, Nigeria, South Africa and Uganda.

In this study blood cholesterol results indicated significant difference between location (t (260.480) = -2.982, p= 0.003). Urban women show high levels of cholesterol in the study compared to rural women. A significant positive correlation between age and blood cholesterol (M= 4.57±0.83, r =0.340, p<0.0005), in urban women (M=4.71± 0.89, r =0.395, p<0.0005) and rural women (M=4.42±0.72, r =0.267, p=0.002). In both urban and rural women blood cholesterol was associated with older women than younger ones. In a cross sectional study done in Angola on 615 participants, by Capingana et al. (2013), the results indicated that (45%) of the sample had raised blood pressure, (11%) had hypercholesterolemia, (50%) had low HDL-C and (10.6%) had hypertriglyceridemia. Another similar study done in Benin on 514 adults on cardio metabolic risk factors, the findings showed that low HDL-C was observed in more than (25%) of participants and low HDL-C was associated with more abdominal obesity in men and women and with more insulin resistance in women.

Physical activity in most Sub-Saharan Africa is part and parcel of daily routine of walking in searching for water and gathering food, (Steyn, 2010). Physical activity is more common in the rural compared to the urban areas since the rural populations rely on walking as a means of transport and often have labour-intense agricultural activities as their main occupation, (Mbanya et al., 2014). The IPAQ was used to measure the Physical activity levels of the sample population and the results of the population indicated high levels of PA. In rural population 79.3% had high levels, 20.0% moderate, 0.7% low, and in the urban population 77.9% had high levels, 19.3% moderate, and 2.9% low.

Among the four IPAQ domains rural women PA levels were more dominated in transport and domestic domains compared work and leisure. Our analysis confirm that rural dwelling in the country is associated with significantly longer distance to access places (medical health centres, water points, ploughing fields and transport among other things), compared to urban areas were all these are easily accessible. In a study done by Dabrowska et al. (2015) on Polish women indicated that a moderate physical activity level was presented by most midlife women in domestic and garden domain, active transportation and leisure-time domain, and a significant correlation noted between physical activity, age and education with BMI. The findings of study differ with the studies done in other countries on PA levels in urban population, where the results indicate low levels of PA and sedentary lifestyle. It can be attributed to the fact that PA levels are difficult to standardize and measure across populations in different countries (Hu et al., 2004).

The finding in the study indicated a significant positive correlation between age and IPAQ job related domain in urban women ($r = 0.208$, $p < 0.0005$). In rural women a significant negative correlation was indicated between age and IPAQ leisure ($r = 0.169$, $p = 0.047$). It can therefore be argued from the findings that urban older women are employed in the study and their working duties involve moderate to high physical activities compared to older rural women whom most are not employed. Older rural women seem to be associated with less interest in leisure-time activities, the reasons possibly being lack of knowledge of the importance of leisure to life, time to engage in leisure activities or the environment not having leisure activities.

There is a significant difference between energy consumption per day and location in the study population ($M = 2187.73 \pm 242.932$kcals) for urban area and ($M = 2020.42 \pm 292.908$kcals), $t(278) = -5.202$, $p = 0.000$. Urban women indicated high consumption of protein and fat ($M = 91.73 \pm 14.731$g, $M = 86.87 \pm 15.037$g, $t(278) = -2.730$, $p = 0.007$) ($M = 52.44 \pm 16.342$ g), $t(278) = -5.864$, $p < 0.0005$.), than rural women respectively. High energy, protein and fat consumption is more prevalent in urban women than in rural women. Women in urban areas in the country believe that by eating fat food with high calories and fat is associated with high standards of living

compared to rural women who eat more agriculture products that they produce from their fields, hence the increase in BMI in urban women which then expose them to high non-communicable disease risk.

Mbochi et al. (2012) in their study states that, the dietary intake of the women confirms what we know about nutrition transition, those women having the highest protein (beef, chicken, processed meats) and fat intake had the highest mean BMI. A similar finding with our study where urban women have high consumption levels of energy, protein and fat, and there BMI is higher than rural women. Mokhtar et al. (2001) in their study in two countries (Tunisia and Morocco) indicated that obese women take in significantly more calories and macronutrients than normal weight women, the percentage contribution to calories from fat, protein and carbohydrates seems to be within normal limits, where fat intake is high (31%) in Tunisia and carbohydrate intake (65-67%) is high in Morocco.

In the study the results showed a significant positive correlation in urban women between age and energy consumption ($r = 0.307$, $p < 0.0005$), protein ($r = 0.237$, $p = 0.001$), and fats ($r = 0.271$, $p = 0.001$). From the study it can be alluded that older women in urban areas, most of them employed, tend to prefer fast food associated with high calories and fat than home cooked food, hence the increase in BMI leading to high prevalence of chronic diseases. The link that most of the older urban women in the study were employed was shown in IPAQ questionnaire results which indicated a significant positive correlation between age and IPAQ work/job related ($p = 0.014$).

Quality of life results indicted high levels in both rural and urban population with the social, physical health domains dominating other domain. The environmental domain had lower levels of presentation in both urban rural areas. Rural area was high physical health domain with 70.57%vs 68.67% for urban, and urban area had high presentation in social domain with 71.30% vs 67.99% for rural. The rural lifestyle is associated with intense agricultural activities as the main occupation, hence the high score on physical health domain in rural women than urban women.

Urban women had high score in social domain, this can be promoted by a high social lifestyle in the urban areas of the country. Netuveli and Blane (2008) found that the majority of older adults rate their quality of life positively in relation to social contacts, dependency, health, mental aspects and social comparisons. Various studies indicate that regular, sustained physical activity participation by older adults is associated with an improved quality of life in the later years (Katzmarzyk, 2010). The study corroborates with other studies indicated, high level of physical activity and high levels of quality of life were indicated especially on the physical health domain and social domain.

A significant negative correlation between age and quality of life physical health domain was indicated (M=69.62±16.12, r =-0.278, p<0.0005), psychological domain (M=65.34 ±12.50, r =-0.141, p=0.018), in rural women psychological domain (M=65.14 ±13.35, r =-0.190, p=0.025), rural women age and environment domain (M=53.32±13.28, r =-0.180, p=0.035), and for urban women age and physical health (M=68.67±15.50, r =-0.262, p=0.002). The results show that older rural women are associated with low quality of life in the psychological domain. Most women on menopause have negative feelings like anxiety, bad mood, depression, and they cannot concentrate. According to Nowosielski and Skrzypulec-Plinta (2011), approximately 86% of menopause females suffer from hot flashes, other symptoms include joint pains, fatigue, depression, anxiety, vaginal dryness and other sexual problems and as such regular physical activity is recommended

3.6 Study Limitations

The main limitation to this study was the sample size. A larger sample would have been able to provide more insight to the determination of overweight, obesity, chronic risk disease and physical activity in women and if all the three residential categories (high, middle and low density) were sampled. Participants were requested not to eat anything after a certain time in previous evening before they could participate in the study the following morning but it was difficult to measure adherence to this request, which is a limitation and a challenge to validity of the glucose results. The study did not use objective methods of collecting physical activity data which could reduce validity due to financial implications.

3.7 Conclusion

This study determined and compared the overweight, obesity, chronic disease risk and physical activity levels of women in Zimbabwean communities. The findings of this study are comparable with other studies done elsewhere. There was a considerable prevalence of overweight and obesity in the study population and the prevalence of overweight and obesity in terms of BMI and waist circumference were significantly higher in urban women than rural women. The disease risk in terms of BMI and WHR was high or very high in urban women who could have been influenced by their larger body size due to higher energy, protein and fat consumption compared to rural women. Furthermore, the rural women showed an unexpected high prevalence of raised blood pressure than in urban women. In terms of blood glucose levels, most of the subjects were non-diabetic. The blood cholesterol levels in urban women were significantly higher than rural women. Finally, rural women had marginally higher physical activity levels though the physical activity levels were generally high for both groups. The difference in BMI, WHR, disease risk and physical activity levels are generally similar to studies done in other low –income countries.

Both rural and urban groups showed high quality of life. The BMI for rural women despite being lower than that of urban women is in the overweight category indicating that the Zimbabwean women are catching up the pace of changing lifestyles in urban cities which is a cause for concern.

CHAPTER FOUR: CONCLUSION AND RECOMMENDATIONS

The aim of this study was to compare weight, chronic disease risk and physical activity levels among the urban and rural women in communities in Zimbabwe between the ages of 18-60 years. It was hypothesized that there was a difference in weight between urban and rural women in Zimbabwe. The findings show that the women in this study in both rural and urban areas showed a prevalence of overweight and obesity, with urban women showing higher trends in BMI and WC compared to rural women. An unhealthy diet has greater influence on BMI in the urban women. The study findings indicated higher caloric consumption among these women. The trends identified in this study are similar to most study findings from other countries. Hypothesis 2 stated that there was a difference in chronic disease risk between urban and rural women in Zimbabwe. It is evident in the study that urban women at a higher risk of chronic diseases and this is attributed to by an increased BMI and WC. Raised blood pressure findings amongst the rural women were unexpected as there were in contrast with what was hypothesized. Hypothesis 3 stated that there is a difference in physical activity levels between urban and rural women in Zimbabwe. Both urban and rural women showed high levels of physical activity. The transport and domestic domains dominated in the rural women while the leisure domain was higher in urban women which might have a positive influence on their quality of life. In terms of quality of life, the urban women had higher scores on the social domain while the rural women had higher scores on the physical health domain.

It is recommended that further studies be done with a larger sample using the same age group and the same methods, and cover a large area in urban areas (low, medium and high density areas). It is recommended that the same study be done in addition with more variables included like socio economic status, education and alcohol intake. Another recommendation suggested for further research is on physical activity and dietary intervention on overweight and obese women. In addition these studies should include men for gender comparisons. Research that include interventions in this population will also be beneficial.

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APPENDICES

Appendix A

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

07 October 2015

Ms S Mhlanga (214584885)
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Protocol: Obesity, overweight, chronic disease risk and physical activity levels in Zimbabwe women.
Degree: MSc
BREC reference number: BE380/15

EXPEDITED APPLICATION

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 18 August 2015.

The study was provisionally approved pending appropriate responses to queries raised. Your responses received on 02 October 2015 to queries raised on 23 September 2015 have been noted by a sub-committee of the Biomedical Research Ethics Committee. The conditions have been met and the study is given full ethics approval.

This approval is valid for one year from **07 October 2015.** To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2015), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be **RATIFIED** by a full Committee at its meeting taking place on **10 November 2015.**

We wish you well with this study. We would appreciate receiving copies of all publications arising out of this study.

Yours sincerely

Professor J Tsoka-Gwegweni
Chair: Biomedical Research Ethics Committee

cc supervisor: sookan@ukzn.ac.za
cc postgrad: nenep1@ukzn.ac.za

Biomedical Research Ethics Committee
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Appendix B

INFORMATION SHEET

TITLE: OBESITY, OVERWEIGHT, CHRONIC DISEASE RISK AND PHYSICAL ACTIVITY LEVELS IN ZIMBABWEAN WOMEN.

Invitation

You are invited to participate in a research study aimed at determining the obesity, overweight, chronic disease risk and physical levels in Zimbabwean women. This study is being conducted by a Masters candidate from University of KwaZulu- Natal, South Africa – Sinikiwe Mhlanga Student Number 214584885.

Purpose of the study

The purpose of the study is to determine the obesity, overweight, chronic disease risk and physical activity levels among the urban and rural women in communities in Zimbabwe. Body mass index and waist-hip ratio will be used to determine obesity and overweight levels. Blood sugar, cholesterol and pressure will be used to determine the chronic disease risk while the physical activity levels of urban and rural women in Zimbabwe questionnaires will be used.

Voluntary participation

Your participation in the study is completely voluntary and you may choose to stop participating at any time. Your decision not to volunteer will not influence the relationship you may have with the researchers or study staff.

Withdrawal from the study

You can stop participating in the study at any time, for any reason, if you so decide. Your decision to participating, or refuse to answer particular questions, will not affect your relationship with the researchers. In the event you withdraw from the study all associated data collected will be immediately destroyed whenever possible.

Procedures and duration

If you decide to participate in the study, body measurements will be done to you and these include: mass, height, waist and hip circumferences. Blood sugar, blood cholesterol and blood pressure will be measured. You will be required to fill in four questionnaires (international physical activity questionnaire, medical questionnaire, nutrition questionnaire and quality of life questionnaire). Body measurements will take about 10 minutes. Filling in the questionnaires will take approximately 20 minutes. All these measurements will be done at your home.

Benefits and/or compensation

There are no direct monetary benefits to participating in the study. This research will not provide a benefit to you. The overall goal is to reveal the patterns of obesity, overweight,

chronic disease risk and physical activity levels among the urban and rural women in communities in Zimbabwe. Thus, it will provide information to policy and health planners in Zimbabwe and other developing countries to set priorities mobilize and allocate resources to programs to control and prevent obesity and overweight in women.

Risks and discomforts

There are no anticipated risks to your participation. When you feel some discomfort at responding to some questions, please feel free to ask to skip the question.

Confidentiality

Any information that is obtained in connection with the study and can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. The information collected about you will be coded using initials and numbers. The data will be kept or stored in the investigator's locked file cabinet and password protected computer. The data will stored for approximately seven years after the study has been completed and then destroyed. When the results of research are published or discussed in conferences, no information will be included that will reveal your identity.

Questions about research

If you have any questions or concerns about the research, please feel free to contact the following:

Principal Investigator:
Sinikiwe Mhlanga
Tel: +263774908305, +277622766874
email: snixmh@gmail.com

Supervisor:
Takshita Sookan

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Thank you for taking the time to consider this study. If you wish to take part in it, please sign the attached consent form.

This information sheet is for you to keep.

Appendix C

INFORMED CONSENT

Date:

Dear Participant

I am asking for your voluntary participation in my Masters Research study. My name is Sinikiwe Mhlanga a student at University of KwaZulu-Natal, South Africa; Student number 214584885. Please read the information sheet attached about the project. Take as much time as you need and fell free to consult any of friends and relatives. If you decide to participate, please sign in the space provided below.

I ……., consent to participate in the study: Obesity, overweight, chronic disease risk and physical activity levels in Zimbabwean women conducted by Sinikiwe Mhlanga Student Number 214584885. I have understood the nature of this project and wish to participate. I am not waiving any of my legal rights by signing this form. My signature below indicates my consent.

Signature …… Date……

Participant Name……..

Signature …….. Date……...

Principal Investigator's name……..

Appendix D

Obesity, Overweight, Chronic Disease Risk and Physical Activity in Zimbabwean Women

Data Sheet

Date of Birth …… **Test Date …….**

Anthropometric Variables

	ID	SITE	1	2	MEAN/ MEDIAN
Basic	1	Body Mass/ Weight (kg)			
	2	Height (cm)			
Girths	3	Waist (minimum) (cm)			
	4	Gluteal (hips) (cm)			

	ID	TEST	1	2	
Blood	1	Blood Pressure			
	2	Blood Glucose			
	3	Blood Cholesterol			

Appendix E

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that you do as part of your everyday life. The questions will ask you about the time you spent being physically active in the last 7 days. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

PART 1: JOB RELATED PHYSICAL ACTIVITY

The first section is about your work. This include paid jobs, farming, volunteer work, course work, and any other unpaid job that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. These are asked in Part 3.

1. Do you currently have a job or do unpaid work outside your home?

☐ **YES** ☐ **NO**

The next questions are about all the physical activity you did in the last 7 days as part of your paid or unpaid work. This does not include travelling to and from work.

2. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, heavy construction, or climbing up stairs as part of your work? Think about only those physical activities that you did for the last 10 minutes at a time.

☐ **days per week** ☐ **no vigorous job-related physical activity**

3. How much time did you usually spend on one of those days doing vigorous physical activity as part of your work?

☐ **hours per day** ☐ **minutes per day**

4. Again, think about only those physical activities that you did for the least 10 minutes at a time. During the 7 days, on how many days did you do moderate physical activities like carrying light loads as part of your work?. Please do not include walking.

☐ **days per week** ☐ **no moderate job-related physical activity**

5. How much time did you usually spend on one of those days doing moderate physical activities as part of your work?

☐ **hours per day** ☐ **minutes per day**

6. During the last 7 days, on how many days did you walk for at least 10 minutes at a time as part of your work? Please do not count any walking you did to travel to and from work.

☐ **days per week** ☐ **no job-related walking**

7. How much time did you usually spend on one of those days walking as part of your work?

☐ **hours per day** ☐ **minutes per day**

PART 2: TRANSPORTATION PHYSICAL ACTIVITY

These questions are about how you travelled from place to place, including to places like work, stores, movies, and so on.

8. During the last 7 days, on how many days did you travel in a motor vehicle like a train, bus, car, or tram?

☐ **days per week** ☐ **no travelling in a motor vehicle**

9. How much time did you usually spend on one of those days travelling in a train, bus, car, tram, or other kind of motor vehicle?

☐ **hours per day** ☐ **minutes per day**

Now think only about the bicycling and walking you might have done to travel to and from work, to do errands, or to go from place to place.

10. During the last 7 days, on how many days did you bicycle for at least 10 minutes at a time to go from place to place?

☐ **days per week** ☐ **no bicycling from place to place**

11. How much time did you usually spend on one of those days to bicycle from place to place?

☐ **hours per day** ☐ **minutes per day**

12. During the last 7 days, on how many days did you walk for at least 10 minutes at a time to go from place to place?

☐ **days per week** ☐ **no walking from place to place**

13. How much time did you usually spend on one of those days walking from place to place?

☐ **hours per day** ☐ **minutes per day**

PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

This section is about some of the physical activities you might have done in the last 7 days in and around your home, like housework, general maintenance work, gardening, yard work, and caring for the family.

14. Think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, chopping wood, shovelling snow/sand, or digging in the garden or yard?

☐ **days per week** ☐ **no vigorous activity in garden or yard**

15. How much time did you usually spend on one of those days doing vigorous physical activities in garden or yard? ☐ **hours per day** ☐ **minutes per day**
16. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the 7 days, on how many days did you do moderate activities like carrying light loads, sweeping, washing windows, and ranking in the garden or yard?

☐ **days per week** ☐ **no moderate activity in garden or yard**

17. How much time did you usually spend on one of those days doing moderate physical activities in the garden or yard?

☐ **hours per day** ☐ **minutes per day**

18. Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do moderate activities like carrying light loads, washing windows, scrubbing floors and sweeping inside your home?

☐ **days per week** ☐ **no moderate activity inside home**

19. How much time did you usually spend on one of those days doing moderate physical activities inside your home?

☐ **hours per day** ☐ **minutes per day**

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the last 7 days solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

20. Not counting any walking you have already mentioned, during the last 7 days, on how many days did you walk for at least 10 minutes at a time in your leisure time?

☐ **days per week** ☐ **no walking in leisure time**

21. How much time did you usually spend on one of those days walking in your leisure time?

☐ **hours per day** ☐ **minutes per day**

22. Think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do vigorous physical activities like aerobics, running, fast bicycling, or fast swimming in your leisure time?

☐ **days per week** ☐ **no vigorous activity in leisure**

23. How much time did you usually spend on one of those days vigorous physical activities in your leisure time?

☐ **hours per day** ☐ **minutes per day**

24. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the last 7 days, on how many days did you do moderate physical activities like bicycling at a regular pace, swimming at regular pace, and doubles tennis in your leisure time?

☐ **days per week** ☐ **no moderate activity in leisure time**

25. How much time did you usually spend on one of those days doing moderate physical activities in your leisure time?

☐ **hours per day** ☐ **minutes per day**

PART 5: TIME SPENT SITTING

The last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

26. During the last 7 days, how much time did you usually spend sitting on a weekday?

☐ **hours per day** ☐ **minutes per day**

27. During the last 7 days , how much time did you usually spend sitting on a weekend day?

☐ **hours per day** ☐ **minutes per day**

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

Appendix F

Nutrition risk Questionnaire

All data collected and processed will be kept strictly confidential.

1. Sex ……..
2. Age ……..
3. Level of Education

☐ none at all ☐ elementary school ☐ high school
☐ college ☐ university

4. Occupation …….
5. How much sugar do you use?

☐ non, and little or no artificial sweeteners ☐ use only artificial sweeteners
☐ occasionally use sugar, or eat sweets ☐ consider myself a heavy sugar user
☐ use sugar everyday (in coffee, on cereals and or have sweet deserts or snack daily

6. How much salt do you use?

☐ do not add salt at the table ☐ sparingly, use on a few foods
☐ moderately, use on some foods ☐ consider myself a heavy salt user

7. How many beverages containing caffeine do you drink in a day? (e.g coffee, tea, coca, soft drink)

☐none ☐100 -200ml ☐300 – 500ml ☐600 – 800ml ☐900ml +

Scale	**0-2times a week**	**3-6 times a week**	**Once a day**	**2-3 times a day**	**4 or more a day**
8. Foods rich in Vitamin C: oranges, potato, grapefruits, lemons, strawberries, peppers					
9. Foods rich in Vitamin A: Foods that have yellow, orange, red or green leaves: spinach, carrots, squash, melons					
10. Cruciferous Vegetables: cabbage, broccoli, brussel sprouts, cauliflower					
11. Foods that have been smoked and or salt cured: ham, bacon, fish, hot dogs					

12. How many drinks of alcohol do you have in an average week?

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Scale	0	1	2	3	4	5	6+
13. How many servings of protein do you eat daily (1 serving is a : 85g of meat, fish, poultry, ½ cup of dried beans, 2 eggs, 2 teaspoons of peanut butter)							
14. How many servings of vegetables do you eat daily (1 servings is : 1 cup of raw leafy vegetables, ½ cup cooked vegetables, ¾ cup of vegetable juice							
15. How many servings of grains and grain products do you do daily (1 servings is: ½ cup of cereal, pasta or rice, 1 slice of bread, ½ small bagel or 6 crackers							
16. How many servings of fruit do you eat daily (1 servings is : 1 small piece fruit, ½ cup of canned fruit, ¾ cup of fruit juice							
17. How many servings of milk and milk products do you eat and drink daily (1 servings is: 1 cup of milk, yoghurt or pudding, 42g of cheese, 2 cups of cottage cheese							
18. How many servings of foods containing fat and or cholesterol do you eat daily? (1 serving; 85g , or more red meat, or organ meat, 2 tablespoons of regular gravy; 42g cheese, 1 tablespoon of butter, margarine or mayonnaise, 1 cup of whole milk, 2 tablespoons of cream, ½ cup of ice-cream							

19. Do you take dietary supplements that contain calcium?

☐ yes ☐ no

20. Please indicate how often you take the following actions to eat a healthy diet

	Almost always	Most of the time	Seldom	Almost never
Eat breakfast				
Avoid deep fried foods				
Plan ahead when eating				
Avoid late night snacking				
Read food labels carefully				
Choose healthier substances				
Control portions size/ avoid seconds				

21. When do you feel you would be ready to work on your diet/ nutrition habits?

☐ not an issue ☐ not ready to change

☐ willing to change soon ☐ willing to change in the future

Thank you for participating.

Appendix G

Quality of life questionnaire

Instructions

This questionnaire asks how you feel about your quality of life, health or other areas of your life. Please answer all questions. If you are unsure about which response to give to a question, please choose the one that appears most appropriate. This can often be your standard, hopes, pleasures, and concerns. We ask that you think about your life in the last two weeks.

Please read each question, assess your feeling, and choose the best answer on the scale that gives the best answer for you.

1. Sex
2. Age
3. Level of Education

☐ none at all ☐ elementary school ☐ high school
☐ college ☐ university

4. Marital Status

☐ single ☐ married ☐ separated
☐ divorced ☐ widowed

5. How do you rate your quality of life?

☐ very poor ☐ poor ☐ neither poor nor good
☐ good ☐ very good

6. How satisfied are you with your health?

☐ very dissatisfied ☐ dissatisfied ☐ neither dissatisfied nor satisfied
☐ satisfied ☐ very satisfied

The following questions ask about how much you have experienced certain things in the last two weeks.

7. To what extent do you feel that physical pain prevents you from doing what you need to do?

☐ not at all ☐ a little ☐ a moderate amount
☐ very much ☐ an extreme amount

8. How much do you need any medical treatment to function in your daily life?

☐ not at all ☐ a little ☐ a moderate amount
☐ very much ☐ an extreme amount

9. How much do you enjoy life?

☐ not at all ☐ a little ☐ a moderate amount
☐ very much ☐ an extreme amount

10. To what extent do you feel your life to be meaningful?

☐ not at all ☐ a little ☐ a moderate amount
☐ very much ☐ an extreme amount

11. How well are you able to concentrate?

☐ not at all ☐ slightly ☐ a moderate amount
☐ very much ☐ extremely

12. How safe do you feel in your daily life?

☐ not at all ☐ slightly ☐ a moderate amount
☐ very much ☐ extremely

13. How healthy is your physical environment?

☐ not at all ☐ a little ☐ a moderate amount
☐ very much ☐ an extreme amount

The following questions ask about how completely you experience or were able to certain things in the last two weeks.

14. Do you have enough energy for everyday life?

☐ not at all ☐ a little ☐ moderately
☐ mostly ☐ completely

15. Are you able to accept your bodily appearance?

☐ not at all ☐ a little ☐ moderately
☐ mostly ☐ completely

16. Have you enough money to meet your needs?

☐ not at all ☐ a little ☐ moderately
☐ mostly ☐ completely

17. How available to you is the information that you need in your day to day life?

☐ not at all ☐ a little ☐ moderately
☐ mostly ☐ completely

18. To what extent do you have the opportunity for leisure activities?

☐ not at all ☐ a little ☐ moderately
☐ mostly ☐ completely

19. How well are you able to get around?

☐ very poor ☐ poor ☐ neither poor nor well
☐ well ☐ very well

To following questions ask you to say how good or satisfied you have felt about various aspects of your life over the last two weeks.

20. How satisfied are you with your sleep?

☐ very dissatisfied ☐ dissatisfied ☐ neither dissatisfied nor satisfied ☐ satisfied ☐ very satisfied

21. How satisfied are you with your ability to perform your daily activities?

☐ very dissatisfied ☐ dissatisfied ☐ neither dissatisfied nor satisfied ☐ satisfied ☐ very satisfied

22. How satisfied are you with your capacity for work?

☐ very dissatisfied ☐ dissatisfied ☐ neither dissatisfied nor satisfied ☐ satisfied ☐ very satisfied

23. How satisfied are you with yourself?

☐ very dissatisfied ☐ dissatisfied ☐ neither dissatisfied nor satisfied ☐ satisfied ☐ very satisfied

24. How satisfied are you with your personal relationships?

☐ very dissatisfied ☐ dissatisfied ☐ neither dissatisfied nor satisfied ☐ satisfied ☐ very satisfied

25. How satisfied are you with your sex life?

☐ very dissatisfied ☐ dissatisfied ☐ neither dissatisfied nor satisfied ☐ satisfied ☐ very satisfied

26. How often do you have negative feelings, such as blue mood, despair, anxiety, depression?

☐ Never ☐ seldom ☐ quite often ☐ very often ☐ always

27. How satisfied are you with the support you get from your friends?

☐ very dissatisfied ☐ dissatisfied ☐ neither dissatisfied nor satisfied ☐ satisfied ☐ very satisfied

28. How satisfied are you with the conditions of your living place?

☐ very dissatisfied ☐ dissatisfied ☐ neither dissatisfied nor satisfied ☐ satisfied ☐ very satisfied

29. How satisfied are you with your access to health services?

☐ very dissatisfied ☐ dissatisfied ☐ neither dissatisfied nor satisfied ☐ satisfied ☐ very satisfied

30. How satisfied are you with your mode of transportation?

☐ very dissatisfied ☐ dissatisfied ☐ neither dissatisfied nor satisfied
☐ satisfied ☐ very satisfied

Thank for participating