Assessment of Healthy Lifestyle Practices in Type 2 Diabetes Patients and Association with Glycated Haemoglobin Levels in Harare, Zimbabwe

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KEY WORDS

Type 2 diabetes mellitus

Harare

Lifestyle modification

Healthy lifestyle

Health Information

Adherence

Physical Activity

Diet

Smoking

Glycated haemoglobin

DECLARATION

I declare that "Assessment of Healthy Lifestyle Practices in Type 2 Diabetes Patients and Association with Glycated Haemoglobin Levels in Harare, Zimbabwe" is my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Joseph Chipinduro

ACRONYMS

BMI	Body Mass Index
CHWs	Community Health Workers
DM	Diabetes Mellitus
HBA_{1C}	Glycated Haemoglobin
HIV	Human Immuno Deficiency Virus
MIC	Low and Middle Income Countries
MODY	Mature Onset Diabetes of the Young
NCD	Non-Communicable Disease
T2DM	Type 2 Diabetes Mellitus

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DEFINITION OF KEY CONCEPTS

Risk factors: Contributory risks that lead to getting diabetes mellitus as well as facilitate disease progression, such as family history of diabetes, obesity and overweight, inactive lifestyles, poor dietary intake. The risk factors are divided into modifiable and non-modifiable risk factors. In the thesis, modifiable risk factors are those that can be subjected to change in order to influence their effect on diabetes incidence or disease progression whilst the non-modifiable risk factors are not amenable to change.

Obesity: Abnormal or excessive fat accumulation that may impair health. In the study, obesity was defined as body mass index greater than 30kg/m^2. Body mass index was calculated from weight and height measured objectively using a bathroom scale and stadiometer, respectively.

Overweight: The term refers to BMI greater or equal to 25 and less than 30kg/m^2.

Healthy lifestyle: In this study, the term refers to the adoption of the following habits as a way of living; 150 minutes of moderate physical activity such as brisk walking, jogging and gardening per week, eating a healthy diet high in fiber and low in carbohydrates and non – smoking

High fiber diet: In this study a high fiber diet was measured qualitatively and subjectively as consuming vegetables as a large portion of main meals most of the time with 5 servings of fruit per day.

Low carbohydrate diet: In this study, low carbohydrate diet refers to consumption of unrefined carbohydrates in small quantities during main meals, snacking on non-carbohydrate based foods, taking less than one teaspoon of sugar with tea or coffee, drinking less than 3 times per day as well as not consuming fizzy drinks

ABSTRACT

Introduction: The control of type 2 diabetes mellitus (T2DM) is pivoted on adherence to a healthy lifestyle (healthy diet, physical activity and non-smoking). Zimbabwe reports a high burden of T2DM related complications suggesting an increased inability by patients to control their blood glucose levels. This study, therefore, sought to describe the healthy lifestyle practices of T2DM patients in Harare, Zimbabwe and associate these practices with their glycated haemoglobin (HBA1C) levels, a marker for the control of diabetes.

Methodology: A descriptive cross-sectional study was done. Participants were T2DM patients who were 18 years and older from two tertiary hospital diabetes clinics in Harare. Data collection was done using a structured questionnaire which was interviewer-administered along with height, weight and HBA_{1C} measurements. Descriptive statistics were used to describe the study populations. Chi square test was used to calculate statistically significant associations between healthy lifestyle behaviours and demographics or HBA1C levels at the significant level of 0.05%.

Results: A response rate of 96.9% (158/163) was observed in the study. A total of 150 out of 158 (94.9%) participants had complete data for analysis. Participants had a median age of 54 years (IQR 45-65), mean body mass index (BMI) of 27.2 kg/m^2 (SD 3.7) and mean HBA_{1C} levels of 7.6% (SD 1.4). There were more female (55.3%) than male (45.7%) participants while 57.7% (95% CI 49-65) had diabetes related complications. A total of 41%, 95% CI 49-65) 67% 95% CI 59-74) and 100% 95% CI 98-100) were conforming to physical activity, diet and non-smoking, respectively. Diet was the only healthy lifestyle component significantly associated with HBA_{1C} levels (p=0.004). Conforming to a comprehensive healthy lifestyle was significantly associated with gender (p=0.026), understanding diabetes health education (p=0.003) and diabetes related complications (p=0.002) but not significantly associated with HBA_{1C} levels (p=.0.461).

Conclusion: T2DM patients attending diabetes clinics in Harare had low levels of conformity to healthy lifestyle practices despite the majority of patients reporting that they understood diabetes health care education. Future studies need to elicit the barriers to uptake of healthy lifestyle practices among T2DM patients and assess interventions for behavioral change.

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CHAPTER ONE: INTRODUCTION

1.1 Background

1.1.1 Overview of the burden of diabetes

Diabetes mellitus (DM) has become a pandemic affecting 415 million people globally in 2015 with half of them unaware that they have the disease (Cho et al., 2018). Approximately 90% of all cases of DM are type 2 diabetes mellitus (T2DM). It is estimated that the number of people living with DM will escalate by 48% to 629 million by the year 2045 (Cho et al., 2018). Approximately 80% of people with diabetes live in low to middle-income countries (LMIC) (IDF, 2017). Additionally, 279 million of 415 million cases are from urban areas. Despite the African continent having the least number of people with DM compared to other regions, about 16 million people in 2015 had DM; it is projected to have the fastest growing epidemic (Cho et al., 2018). By 2045, Africa will have 41 million cases of diabetes, a 15% increase, the highest for all regions (Cho et al., 2018). It is also in Africa that the highest number of undiagnosed cases (69.2%) and the highest number of deaths attributable to DM (77%). Zimbabwe was shown to have the fourth highest prevalence of DM in Africa reporting a prevalence of 9.7% in 2013 (Peer et al., 2014). Recent estimate on the prevalence of DM are not available due to lack of national surveys. However, in their study Mufunda and colleagues demonstrated that The fifth most common non-communicable disease (NCD) in Zimbabwe is DM (Mufunda et al., 2006).

1.1.2 T2DM and its risk factors

The condition, T2DM, is characterised by a reduction in the production of the insulin hormone due to dysfunctional pancreatic cells and the reduced response of target cells and organs to the action of insulin. Insulin hormone acts by increasing the uptake of glucose from the blood by cells. When insulin is deficient, or cells have decreased sensitivity to insulin, blood glucose levels are persistently high resulting in T2DM (Holman et al., 2008).

Factors that are associated with the development of T2DM are stratified into modifiable and non – modifiable risk factors (Ley et al., 2015) (Figure 1). Asians, Hispanics and Africans are at increased risk of developing T2DM as well as being a male (ADA, 2017).

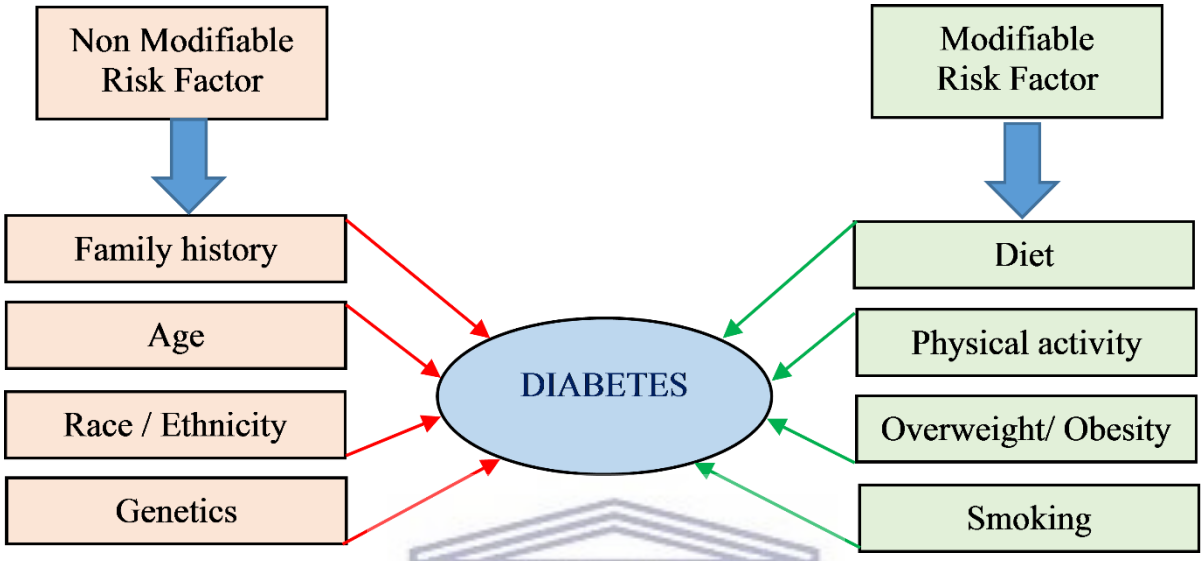


Figure 1: Modifiable and non- modifiable risk factors of diabetes

As a person ages, the risk of DM increases more so after the age of 65 years (Centers for Disease Control and Prevention, 2011; Suastika et al., 2012). However, there is a growing incidence of DM in the younger age group (15 – 30 years), which is characteristic of T2DM but more aggressive with early mortality; referred to as maturity-onset diabetes of the young (MODY) (Constantino et al., 2013). The MODY is associated with a monogenetic disorder, that is, arises from a single genetic mutation. Genetic factors, however, exert their influence following exposure to obesogenic environments.

Obesogenic environments include high sugar and fat diets as well as sedentary living representing the modifiable risk factors. The increasing prevalence of obesogenic environments is mostly attributable to globalisation (Basch et al., 2013). Globalisation is referred to as the growing movement of ideas, people, commerce and financial capital (Basch

et al., 2013). Regrettably, this movement of shared ideas has resulted in a change in societal norms and lifestyle with relevant risk factors of diabetes prevailing worldwide, namely; poor diet, physical inactivity and tobacco smoking (Basch et al., 2013; Hu, 2011). Similarly, urbanization has exposed people to the obesogenic environments of cities which are rampant with fast food outlets and readily available transportation systems such that people tend to eat poorly and do less walking. Adopted poor diets are characterised by high sugar and high-fat content lacking in fiber contents such as fruits and vegetables (Maina et al., 2010; Vorster et al., 2005). Poor diet coupled with sedentary living is a catapult for T2DM. Additionally, smoking tobacco, an increasing habit is associated with a 45% increased risk of developing diabetes (Willi et al., 2007)

1.1.3 Complications of T2DM

DM is a gradual progressive condition which coupled with poor adherence to treatment results in life-threatening complications as a result of persistently increased blood sugar levels. Complications of diabetes include cardiovascular disease, blindness and failure of organs such as kidneys. It is also responsible for amputations of lower limbs especially in low-income countries (IDF, 2017). Zimbabwe has been shown to have a high prevalence of T2DM complications (Saravoye, 2014; Mafuratidze et al., 2014), suggesting a high degree of non-compliance to treatment by these patients. Therefore it is essential to provide a support system, through the health delivery system or social support**.**

In order to provide interventions that are tailor-made to the needs of T2DM, it is essential to understand the current health practices T2DM patients are adhering to if any. An understanding of the current health practices will direct the primary focus of interventions, whether to enhance existing practices or stimulate an appreciation of healthy lifestyle uptake.

1.1.4 Interventions in the management of T2DM

Most risk factors and determinants of DM are preventable requiring a comprehensive approach in the management and prevention of the disease. Indeed the curative approach lessens the burden of T2DM by providing blood glucose lowering medication as well as frequent monitoring for complications and assessment of long-term control via glycated haemoglobin (HbA_{1C}) levels (IDF, 2015. Notably, the preventive approach works towards eliminating the risk factors to T2DM, while health promotion is an interplay of health education, awareness at the individual to the community level and the adoption of a healthy lifestyle. Modifiable risk factors that may be targeted at by health promotion and prevention include obesity, high fat and carbohydrate diets and alcohol consumption (Ley et al., 2015; Alberti et al., 2007; Jeon et al., 2007).

The management of T2DM is centred on adherence to a healthy lifestyle. Adherence to healthy living, (mainly 150 minutes of moderate physical activity per week, non-smoking and high fiber/ low carbohydrate diet) reduces blood glucose levels (DPP, 2002). In Nigeria, T2DM patients were found to be obese, living a sedentary lifestyle and hypertensive (Oguntibeju et al., 2012) suggesting non-compliance to a healthy lifestyle. Diabetes is regarded as the most demanding condition psychologically and behaviorally as it generally requires frequent self-monitoring of blood glucose, dietary modifications, exercise and proper administration of the prescribed medication (Mandewo et al., 2014). Patients require a certain level of motivation and readiness to change for lifestyle behavior changes to be effected (Koenigsber et al., 2004). In planning type of change in individuals, Koenigsber and colleagues (2004) suggest that a physician should motivate patients to come up with self–monitored goals, which they are likely to adhere to.

1.1.5 Harare District Setting:

Harare, the capital city of Zimbabwe with a total population of about 1 600 000, has an age-sex structure that is not well documented but adults, aged 15-64years comprise 66% of the population, 31.9% under 15years and 1.8% over 65years (Harare District Annual Health Report, 2008). Increasing age from 20-80 years is associated with increased risk of T2DM in Zimbabwe (IDF, 2015). Socio-economic status is diverse although the majority is of a low financial status. Some people reside in informal settlements, which do not have facilities that promote health such as parks playgrounds and clinics (Harare District Annual Health Report, 2008). The district is host to 45 primary care and seven tertiary referral centers. There is a liaison between the public and private sectors regarding promoting policies, but the private sector mostly caters for the affluent.

1.2 Problem Statement

There is an increased burden of DM in Zimbabwe (> 90% of which is T2DM) (Mufunda et al., 2006). In 2013, the prevalence of DM was 9.7% in Zimbabwe, and the country was ranked the fourth country with the most prevalent diabetes cases in Africa (Peer et al., 2014). Accompanying the increase in the prevalence of DM is a high prevalence of diabetes-related complications. An overall 45% prevalence of DM complications were found in adults presenting with all forms of diabetes at a diabetic clinic in a referral hospital in Zimbabwe (Saravoye, 2016). Included amongst the factors significantly associated with diabetes complications was having T2DM, low physical activity, high serum low-density lipoprotein levels and poor glycemic control (Saravoye, 2014). Findings from another study showed that the prevalence of renal impairment in T2DM patients was 27% (Mafuratidze et al., 2014). The association of diabetes complications with poor health lifestyle is worrisome. Diabetes is a condition that demands behavioural modification as it requires self-monitoring, dietary modification, exercise and proper administration of prescribed medication. Counselling and

educational sessions are required for diabetes patients. In an exploratory study of patient beliefs about diabetes in Zimbabwe, patients revealed limited knowledge and self-care practices (Mufunda et al., 2012). The participants cited less time spend with physicians per consultation resulting in little information being imparted and virtually no counselling sessions taking place. Additionally some patients are inclined towards physical activity such as playing ball games as opposed to others like brisk walking and so the lack of adequate communal facilities in Zimbabwe potentially leads to reduced physical activity in some patients. The available facilities come at the cost of approximately $10/hour which is not affordable for the majority. These challenges may, therefore, hinder uptake of healthy living especially for diabetic patients who have the greatest need.

1.3 Rationale of Study

This study was carried out to gain an understanding of the healthy lifestyle practices (that is, intake of a high fiber - low-carbohydrate diet, physical activity and smoking) that have been adopted by T2DM patients in Harare, Zimbabwe. Diabetes control is mainly pivoted on lifestyle modification (IDF, 2017). There is paucity of data that describes the lifestyle behaviours of T2DM patients in Zimbabwe. In a health care system that relies on a curative approach and whose health education and promotion aspect is hindered by increased workloads. Findings from the study could inform interventions to reduce complications of DM among patients and maximize the benefits of management and control of the disease among the patients.

1.4 Research Questions

- What are the healthy lifestyle practices (high fiber-low calorie diet, physical activity and smoking) of T2DM patients attending a diabetic clinic in Harare, Zimbabwe?
- What is the effect of healthy lifestyle practices adopted by T2DM patients in Harare towards serum glycated haemoglobin levels?

1.5 Aim

The overall aim of the study is to assess healthy lifestyle practices (high fiber-low calorie diet, physical activity and non-smoking) adopted by T2DM patients and the association with glycated haemoglobin levels in Harare, Zimbabwe.

1.6 Objectives

- To determine the proportion of T2DM patients conforming to healthy lifestyle practices in Harare.
- To determine the levels of glycated haemoglobin in T2DM patients.
- To determine the association between glycated haemoglobin levels and healthy lifestyle practices in T2DM patients.

1.7 Outline of the thesis

Chapter one gives a brief introduction on diabetes in particular T2DM with a focus on modifiable risk factors and interventions for management and complications. It further articulates the research problem, the rationale of the study and its objectives.

Chapter two discusses the literature review. It highlights the context of the research problem and provides a critical appraisal of the literature on lifestyle interventions for T2DM patients.

Chapter three describes the research aim and objectives; methodology and study design, sampling of respondents; data collection methods; data handling and analysis; as well as study limitations and ethical considerations.

Chapter four focuses on the results obtained from the study and their interpretation.

Chapter five discusses the study findings in relation to literature.

Chapter six outlines the conclusion and proposes recommendations based on the study results

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The review illustrates the burden of diabetes globally, regionally and in Zimbabwe. It provides an understanding of T2DM in relation to modifiable risk factors. Furthermore, the review provides evidence from the literature on the contribution of these factors towards T2DM outcome and the patient and community interventions that have been employed to manage and control T2DM.

2.2 Burden of diabetes

2.2.1 Global Prevalence of Diabetes

The global burden of DM shows an exponential increase with the worldwide prevalence increasing by more than 50% over the last 30 years (Cho et al., 2018). In 2017, approximately 415 million people were estimated to have diabetes (Table 1) with more than 90% having type 2 diabetes mellitus (T2DM) (IDF, 2017). It is expected that by 2045, about 693 million people will have diabetes (Cho et al. 2018). Additionally, 374 million people have impaired glucose tolerance and are therefore predisposed to diabetes while nearly half (49.7%) of people living with diabetes remain undiagnosed (IDF, 2017). Diabetes is fast becoming a global pandemic that has no partiality affecting both young and old, females and males and across ethnic groups. However, diabetes shows a predisposition to people living in urban areas (279 million) compared to those in rural areas (146 million) (IDF, 2017). Additionally, 30% of people with diabetes are more than 65 years old. A total of 4 million adults died from diabetes in 2017 showing that more people die from diabetes than from infectious diseases of tuberculosis, malaria and HIV combined (total of 3.4 million deaths). Approximately 46% of deaths from diabetes occur below the age of 60 years, globally.

2.2.2 Burden of diabetes in Africa

Over 75% of global diabetes cases occur in low to middle-income countries (IDF, 2017). Africa hosts many of these countries with a reported prevalence of diabetes of 3.3% (15.5 million people) which is expected to reach 3.9 (40.7 million people) by 2045 (IDF, 2017). Most people with diabetes in Africa reside in urban areas (IDF, 2017). As a region with the fastest growing diabetes epidemic, Africa has the highest percentage of undiagnosed diabetes cases (69.2%) and reports the highest diabetes attributable mortality rate (77%) in people below 60 years (IDF, 2017). Mortality due to diabetes is 1.6 times higher in men than women in Africa (IDF, 2017).

Figure 2: Estimated total number of adults (20-79 years) living with diabetes, 2017 (IDF, 2017)

2.2.3 Burden of diabetes in Zimbabwe

Zimbabwe is ranked fourth among African countries in Africa with high diabetes prevalence rate (Peer et al., 2014). Due to lack of national DM prevalence studies, the latest information

in 2006 shows that DM is ranked fifth among non-communicable diseases with the highest disease prevalence. (Mufunda et al., 2006)

The country's published estimate of diabetes prevalence is derived from a meta-analysis study which observed an increasing trend in the prevalence over the past three decades (Mutowo et al., 2015). The prevalence of diabetes in Zimbabwe was reported to be 5.7% by analyzing data from seven studies carried out within a 45 year period from 1961 to 2006 (Mutowo et al., 2015). Therefore, the estimated DM prevalence may not reflect the existing DM prevalence in Zimbabwe. Furthermore, except for one study which estimated DM prevalence in greater than one to 60 year old people, all the other studies determined DM prevalence from a population of adolescents and adults. The studies that were reviewed and analysed in the meta-analysis were predominantly carried out in urban areas (five versus two in rural areas). One of the study was able to demonstrate the high occurrence of DM among females compared to males. Further analysis according to setting and gender were not reported in the meta-analysis (Mutowo et al., 2015). The latest estimate of DM prevalence in 2006 provide a more recent understanding of the prevalence of DM in Zimbabwe,

2.3 The modifiable risk factors of diabetes

Whereas genetics and age play a role in the complex etiology of diabetes, modifiable factors such as obesity, sedentary living and poor diet clearly enhance the risk of developing diabetes and its rapid progression (Tuei et al., 2010).

2.3.1 Obesity

Many of the modifiable risk factors provide an enabling environment for obesity to ensue (Hu, 2011). Obesity may be regarded as a major risk factor for T2DM. A person is obese when the body mass index (BMI) is greater than or equal to 30 kg/m^2. A review of 52 studies demonstrated that BMI as a marker for obesity was an independent predictor of T2DM (Qiao

and Nyamdorj 2010). Conversely, loss of weight reduced the risk of diabetes by 3% over ten years (Aucott 2008). Obesity results in abundant free fatty acids within plasma which in-turn confer cellular resistance to insulin promoting a diabetic state (Yaturu, 2011). However, it is not general overweight that provides the greatest risk for the metabolic disorder, rather the accumulation of visceral fat characterised by central obesity around the abdomen (Liu et al., 2010). Abdominal adiposity has consistently been shown to be significantly associated with the development of T2DM in Japanese and Chinese people (Chen et al., 2012; Wander et al., 2013), populations that are generally not obese. Similarly, in Africans, abdominal obesity is significantly associated with T2DM as demonstrated in Senegal (Seck et al., 2015), Nigeria (Ekpenyong et al., 2012) and South Africa (Levitt et al., 1999; Motala et al., 2008). For instance, in Senegal, the odds of having diabetes was 1.7 times higher for adults with abdominal obesity compared to those without ($p = 0.05$) (Seck et al., 2015).

2.3.2 Diet

The growing epidemic of obesity and T2DM are mainly a result of poor eating habits. Globalisation has resulted in the transition from healthy low-calorie dietary patterns to high-calorie diets rich in sugars and saturated fats (Basch et al., 2013). The study in Ghana demonstrates how urban populations are adopting poor dietary habits predisposing to T2DM (Frank et al., 2014). The quality of diet is an important independent predictor for T2DM (Hu et al., 2001).

Carbohydrates

The amount and type of carbohydrate affects the postprandial blood glucose levels. Reduced amounts result in a low glycaemic response. The American Diabetes association recommends an amount of 130g /day of carbohydrate for adults (ADA, 2008). Low calorie diets over 24 weeks were shown to have a significant beneficial effect on; body weight, BMI, waist

circumference, blood glucose levels and high-density lipoprotein levels (Hussain et al., 2012). Recommended carbohydrates with a low post-prandial glycaemic response include oats, barley, beans, lentils, legumes, pasta, whole wheat bread, apples, oranges, milk, yogurt (ADA,, 2008). In Israel, overweight 259 T2DM patients had a mean weight loss of 8.3kg and significant reduction in HbA_{IC} levels in one year when they were put on a low carbohydrate, traditional Mediterranean diet compared to those on the American Diabetes Association recommended diet (Elhayany et al., 2010). The Mediterranean diet focused on providing quality with reduced quantity of carbohydrate whilst the American Diabetes Association recommended diet focused on reducing the quantity of carbohydrate irrespective of type thus demonstrating the importance of quality carbohydrate intake in the control of T2DM (Elhayany et al., 2010).

Likewise, an increased intake of refined carbohydrates such as white rice and white bread predisposes to T2DM and accelerates its progression, while a diet rich in polyunsaturated fats, and high fiber reduces the risk of T2DM by 21% (Hu et al., 2007). Similarly, increased sugar intake has an adverse effect predisposing to T2DM and accelerating disease progression. A meta-analysis study provided evidence that consumption of sugar-sweetened beverages induces a 26% risk for diabetes (Malik et al., 2010). Furthermore, sugar-sweetened beverages contribute to overweight and obesity (Basu et al., 2013; Hu et al., 2001) and thus an increased risk for T2DM and incidence of T2DM complications.

Fiber

The recommended fiber intake for T2DM patients as well as the general population is greater or equal to 5g of fiber per serving (ADA, 2008). Foods with a high fiber content include legumes (such as beans, peas and cow peas), cereals, fruits, vegetables, and whole grain products. Increased whole grain intake including cereal fiber was inversely associated with the risk of T2DM (Schulze et al., 2007; deMunter et al., 2007; Montonen et al., 2003). Whole grain

fibers are rich in many vitamins including vitamins B and E. Vitamin B6, and folic acid have the potential to reduce the risk of metabolic disease such as T2DM due to the lower concentration of serum homocysteine (Montonen et al., 2003). Additionally, high fiber tends to increase gastric emptying, reduce post-prandial glucose response and increase insulin resistance (Schulze et al., 2007).

It was further demonstrated by deMunter et al., (2007) that high intake of the fiber rich bran outer coating of whole grains was significantly associated with reduced risk of T2DM than the relatively increased intake of the inner germ. Interestingly, increased intakes of fruit and vegetables, that is three or more servings of fruit and vegetable per day were not associated with a reduction in the risk of T2DM (Schulze et al., 2007; Hamer and Chida, 2007; Carter et al., 2010). However, Carter et al., (2010) did show that increased intake of leafy vegetables alone had a significant association with reduced T2DM risk.

Fat

The recommendations towards dietary fat in the prevention and control of T2DM is to reduce intake of saturated fats to less than 7% of the total calories (ADA, 2008). Saturated fats tend to increase the bad cholesterol, low density lipoprotein which predisposes to cardio-metabolic disorders including T2DM (ADA, 2008). In contrast, two separate reviews show that consumption of vegetable fat which is unsaturated as opposed to largely saturated animal fat is associated with a lower risk of T2DM and increased insulin sensitivity (Riserus et al., 2009; Steyn et al., 2007). Poly unsaturated fats can also be obtained from fish rich in omega-3 fats. Equally important is to reduce the total amount of fat ingested. High fat diets (excluding omega- 3 fats) have been shown to predict the development of a pre-diabetes state. (Steyn et al., 2007). Fat is initially stored in subcutaneous tissue. A high fat diet will result in fat deposits saturating the subcutaneous tissue and large deposits of visceral fat occurring, for example,

around the abdomen (Yaturu, 2011). This leads to central obesity, a significant risk factor for T2DM and its complications.

2.3.3 Physical inactivity

Increased urbanisation and industrialisation has fostered a sedentary way of life in Africa. Many have adopted driving versus walking and entertainment with mobile phones, television and other digital platforms as opposed to manual activities such as playing ball games (Hu, 2011; Tuei et al., 2010). Several studies have documented the significant association between physical inactivity and the incidence of T2DM in African countries including, Nigeria (Nyenwe et al., 2003), Senegal (Seck et al., 2015) and South Africa (Malan et al., 2008; Motala et al., 2008). Similarly, in China, sedentary living has been associated with an increased risk of developing T2DM while physical activity lowers that risk (Hu, 2011). Each 2 hours/ day increment in time spent watching television was associated with a 14% increase in diabetes risk while each 2 hours/day increment in standing or walking around the house was associated with a 34% reduction in diabetes risk (Hu, 2011). Furthermore, watching television tends to be characterised by unhealthy eating habits such as snacking on sugary beverages and fast fatty foods contributing to obesity.

2.3.4 Smoking

Smoking cigarettes is an independent risk factor of T2DM. In current smokers, the risk of developing T2DM was 45% more in current smokers than in non-smokers (Willi et al., 2007). Further, it was observed that the risk in smokers increased with the number of cigarettes smoked per day. Hu (2011) explains that smokers have an accumulation of visceral fat such as around the abdomen, probably due to increased plasma cortisol levels which promote fat accumulation and insulin resistance.

2.3.5 Alcohol intake

As with smoking, excessive alcohol intake increases abdominal adiposity (Howard, 2004). Heavy intake of alcohol (more than 3 drinks/day) has deleterious metabolic effects such as increased caloric intake leading to obesity, liver function impairment and impaired glucose metabolism (Koppes et al., 2005). However, light to moderate alcohol consumption of alcohol was associated with a reduced incidence of diabetes. This was demonstrated in a meta-analysis study of 370 000 individuals followed over 12 years, where the risk for diabetes was reduced by 30 – 40% in those who consumed one to two drinks/day compared with heavy drinkers and non-drinkers (Koppes et al., 2005). Alcohol abuse occurs widely in many African countries and seems to follow cultural norms with excessive intake occurring mostly among men.

2.4 Control of Type 2 diabetes with lifestyle change

The goal of diabetes management is to achieve sustained normal blood glucose levels. Normal blood glucose levels can be achieved mainly through medication or the adoption of a healthy lifestyle. Medicine chiefly works to block insulin antagonistic mechanisms thus promotes the utilisation of the available blood glucose (Yaturu 2011). This approach strongly needs to be augmented with the adoption of a healthy lifestyle to achieve sustainable reductions in blood glucose levels. Specific risk factors that can be modified through healthy living include; diet, physical activity, smoking and alcohol.

Acknowledging that diet is an important factor in the pathophysiology of diabetes, many studies have assessed the effect of dietary interventions in diabetes populations. In England T2DM patients were randomly assigned to a control group (initial dietary consultation with follow up at 6 months) and to an intervention group (dietary consultation every 3 months with monthly nurse support). At 6 and 12 months the intervention group had significantly better glycaemic control than the control group (Andrews et al., 2011). The authors recommend that

regular dietary consultations can help patients adhere to recommended diets and enable their glycaemic control. Interestingly in another study where T2DM patients received nutritional and behavioral counselling on site as well as remote digital couching and education showed a significant reduction in HbA_{1C} at 10 weeks ($p < 0.001$) (McKenzie et al., 2017). It is therefore important that while dietary interventions are effected sustainable patient support structures are established.

While a conventional diabetes diet is beneficial, Kahleova et al., (2010) demonstrated that a low calorie vegetarian diet is more beneficial in increasing insulin sensitivity and reducing visceral fat. When the vegetarian diet was coupled with physical activity, the benefits were increased.

Physical activity increases the utilisation of glucose and is vital in glycaemic control. The World Health Organisation recommends moderate physical activity such as walking of 150 minutes per week to reduce the risk of diabetes (WHO, 2018).

Interventional studies have demonstrated that by increasing physical activity, the risk of T2DM is reduced and glycaemic control is achieved (Sanghani et al., 2013); Andrew et al., 2011). The infamous diabetes prevention program revolutionised the management of T2DM by demonstrating that lifestyle intervention of a low-calorie diet with brisk walking of 150 minutes per week reduced the incidence of diabetes by 58% (DPP, 2002). Andrews and colleagues (2011) provided further evidence in T2DM patients when a lifestyle intervention of diet and pedometer-based activity significantly ($p < 0.001$) reduced HbA_{1C} levels after 12 months compared to a control group receiving usual care (Andrews et al., 2011).

Again the benefits of physical activity and its impact on glycaemic control were demonstrated in Indians by Sanghani et al., (2013). In their study, previously sedentary and obese T2DM patients were randomly assigned to a structured exercise group and an

unstructured exercise group. Structured exercises meant planned, individualised and supervised exercises co-ordinated by the physiotherapist. After 6 months, individuals in the structured exercise group were associated with significantly reduced glycated haemoglobin levels 0f 0.59% while those in the unstructured group had a non-significant reduction of 0.14% (Sanghani et al., 2013). The authors concluded that patients need to be stimulated to participate in specifically designed exercise intervention programs. Best practices, however, need to employ a comprehensive lifestyle approach which holistically acts to achieve better glycaemic control.

In the LOOK AHEAD trial (2010), obese T2DM patients were randomised to an intensive lifestyle intervention focused on diet and physical activity with caregiver support and counselling. Specifically, the intervention included a low calorie diet calculated using initial patients' weight, at least 175 minutes of physical activity per week, using activities similar in intensity to brisk walking and behavioral strategies included self-monitoring, goal setting and problem solving. Participants in the intervention arm were seen weekly for the first 6 months then every 3 months for the next 6 months and monthly up to 4 years. The control arm had group sessions with diabetes support and education three times a year. After four years of follow up, the intervention group reported greater weight loss (−6.15% vs −0.88%, p<.0001) and improved HbA_{1C} levels (−0.36% vs 0.09%, p<.0001) than the control group (Look AHEAD Research Group, 2010). Similar observations were obtained in South Korea (Yoo et al., 2007). Whereas outcomes are easier to demonstrate in controlled trials, in reality, outcomes are dependent on patients' knowledge base, self - motivation and supportive behavioral change techniques.

2.5 Barriers to lifestyle modification

Kumar et al., (2018) identified the freedom to eat as the quality of life domain that is mostly affected in the adoption of a healthy lifestyle by T2DM patients. Commitment to a healthy diet is influenced by psychological and behavioral factors (Teixeira et al., 2015). In the study by Koopman et al., (2018), T2DM patients who were unable to restrain from overeating were associated with failure to lose weight after 6 months of follow up. Assessment of eating habits at baseline may help clinicians to prescribe a personalised weight loss treatment schedule for the patient that has minimal chances of failure.

Admittedly, knowledge of a condition is a critical driver for enhanced adherence to prescribed treatment regimens especially those involving self–management practices such as T2DM. Empowering diabetes patients with knowledge ensures that they are not easily influenced by misconceptions and beliefs that exist in the general populace. A study in Namibia showed that the general adult population had a relatively good understanding of diabetes but also held misconceptions about the disease (Kambinda, 2017). These misconceptions can influence patient self-management resulting in potential adverse outcomes.

A case-control study in Zimbabwe established that health education had a protective effect on the development of diabetes complications (Ponesai et al., 2015). Nonetheless, diabetes patients attending a referral hospital in Zimbabwe showed a lack of knowledge of diabetes in general (Mufunda et al., 2018). Notable knowledge gaps included glycaemic control and diet. In an earlier study with patients attending the Zimbabwe Diabetes Association, the same knowledge gaps were identified (Mufunda et al., 2012). In Pretoria, South Africa, of 217 T2DM patients 92% had poor knowledge on the benefits of a healthy diet, exercise regimen and weight loss (Okonta et al., 2014). It was further observed that 93% of the participants had received no formal education or had only up to primary level and that most of the participants

were poverty stricken. Similarly, most South African diabetes patients from KwaZulu Natal had no formal education and exhibited lack of knowledge about diabetes care (Roux et al., 2018). The lack of formal education entails that educational techniques should be employed to enhance their understanding on diabetes care whilst poverty implies that participants may not be able to access and/ or afford a balanced diet.

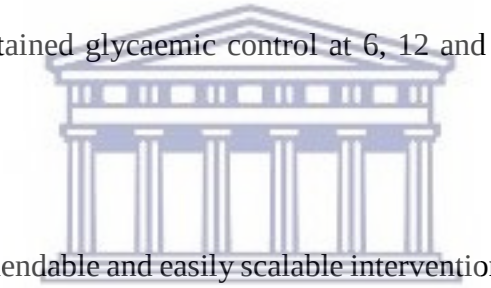
At tertiary hospitals in Zimbabwe, before the commencement of a diabetes clinic, a brief health education session is given by the nurse and hospital nutritionist. The lack of knowledge exhibited in these patients is sufficient to acknowledge that receiving educational talks on diabetes self -care will not necessarily impact on patient knowledge. In Iran, it was observed that T2DM patients had suboptimal knowledge, attitudes and practices on diabetes and that knowledge attitudes and practices seem to improve as the condition worsens (Niroomand et al., 2015). Whether it is initial patient inertia of clinic inertia that contributes to the early poor knowledge attitudes and practices was not clearly understood.

In the African setting adherence by health care workers to standard practices and knowledge of diabetes was demonstrated to be poor (AtienoJalang'o et al., 2014; Tsolekile et al., 2018). A study in South Africa illustrated that clinic inertia plays a part in the poor management and compliance of patients with diabetes and hypertension (Steyn et al., 2008). Of 923 patients at community level health care centres, 33% of hypertensives had high blood pressure while 42% of diabetes patients had high fasting blood glucose levels (Steyn et al., 2008). Patients' knowledge of their condition was poor. Furthermore, prescribed drugs were not recorded for 23% of diabetes and 11% of hypertensive patients (Steyn et al., 2008). It is not surprising then that poor institutional care will translate to poor patient self-care and unhealthy lifestyle practices.

2.6 Techniques to enhance patient knowledge and behavioral change

Despite the poor knowledge and unhealthy practices by T2DM patients, Okonta et al., (2014) noted that patients generally had a positive attitude towards lifestyle behavior change. The positive attitude can be harnessed towards encouraging healthy lifestyle practices. Some techniques have been illustrated to enhance patients' knowledge and foster behavioral change.

The results of a meta-analysis showed that better glycaemic control was achieved when interactive behavior change techniques were employed during health education (Cheng et al., 2017). For instance, interactive learning employing skills training and group discussions fostered behavior change towards healthy living (Rygg et al., 2017). In Latinos, diabetes self - management and support led by community health workers (CHWs) and group session led by peer leaders resulted in sustained glycaemic control at 6, 12 and 18 months (Spenser et al., 2018).



The use of CHWs is a commendable and easily scalable intervention. However, they have been shown to have poor adherence to standard practices of diabetes and exhibit poor knowledge (AtienoJalang'o et al., 2014; Tsolekile et al., 2018). Hence training with further refresher courses would be required for CHWs. Puoane (2017) demonstrated that CHWs could be successfully taught about healthy living practices to the point that they adopt these practices in their own lives.

In another study, a multifaceted approach led to better glycaemic control in diabetes patients (Pillay et al., 2016). The approach comprised of a comprehensive patient data capture platform, clinicians retraining on diabetes standards of care and a multidisciplinary team providing patient education on lifestyle modification, self and clinic monitoring. After one year of implementation, it was found that patients had significant reduction in HbA_{1C} levels, waist

circumference, BMI and increased adoption of healthy lifestyle behaviors and home glucose monitoring. The motivation for lifestyle modification takes time and is complex. Therefore it requires regular support and enhancing techniques received from both medical personnel and the community. Without these, it is difficult to be assured of uptake of a healthy lifestyle by T2DM patients.

In summary, there is a growing incidence of people living with T2DM. However, management is centered on modifiable factors which when adopted into a lifestyle habit can slow the progression of the disease and reduce the incidence of diabetes complications. These factors include eating a healthy diet comprised of low carbohydrates, low fat content and high fiber. Additionally, engaging in moderate to vigorous activity for 150 minutes per week is recommended whilst smoking and alcohol intake is discouraged. Whether T2DM patients engage in these lifestyle behaviours is largely unknown. Medical and community interventions involving the participation of the patients have yielded some long lasting effects in motivating patients to adopt healthy living. The use of CHW to lead health clubs is desirable and may encourage patients to be active drivers in managing T2DM.

CHAPTER THREE: STUDY METHODOLOGY

3.1 Introduction

The chapter summarises the study approach used to fulfil the aim and objectives of the study. It describes the study setting, study design, study population, selection of respondents and the methods used for data collection and data analysis.

3.2 Study design

A quantitative research methodology was used which assumed an analytical cross-sectional design. A cross-sectional design is one in which data is collected at a given point in time. The study design may be descriptive, describing what already exists in the setting. Alternatively, cross-sectional designs may be analytical in that associations may be made between an outcome and its contributory factors. Nonetheless, causation cannot be implied as both the outcome and factors were collected at the same time point. Cross-sectional designs are easy to do and relatively cheap.

The cross-sectional design is appropriate for this study as the study seeks to describe the healthy lifestyle practices of T2DM patients as well as determine the effect of their practices on glycemic control to provide evidence to assist in the planning of intervention programs on lifestyle modification for patients with T2DM. The analytical cross-sectional design is also appropriate as it allows associations between variables to be determined at a low cost compared to cohort studies (Stone and Campbell, 1984).

3.3 Sampling frame

The sampling frame consisted of patients who were 18 years and older with T2DM and attending diabetic clinics in Harare. All DM patients attending the Parirenyatwa and Harare Hospital clinics were eligible for enrolment.

3.4 Study population

The targeted population were adults (18+ years) who have diabetes. The inclusion and exclusion criteria were as follows:

3.4.1 Inclusion criteria were as following:

1) Males and females with T2DM

2) Patients aged 18 years and above

3) Patients attending two referral hospitals in the city (Parirenyatwa Hospital and Harare Hospital)

4) Patients with diabetes-related complications were included to allow assessment over the spectrum of the disease.

3.4.2 Exclusion criteria were as follows:

1) T2DM patients with co-morbidities such as chronic lung disease, heart disease and gout were excluded since the management of co-morbidities may present with contraindications to what is in essence encouraged for management of T2DM through healthy living. For example, patients with heart disease may reduce activity to a minimum whereas the management of T2DM promotes physical activity

2) Pregnant women presenting with gestational diabetes – this is commonly a transitional condition and women with gestational diabetes are likely to have different attitudes towards uptake of healthy lifestyle compared to individuals with the chronic condition

3) T2DM patients on insulin management – these patients are likely to have failed management using dietary and lifestyle modification alone or in combination with oral hypoglycaemics. Including them will diffuse any associations that may exist between a healthy lifestyle and HBA_{IC} levels

4) T2DM patients with disabling complications that may limit compliance with a healthy lifestyle such as gangrenous foot or amputations

5) Patients requiring emergency care such as presenting in a glycaemic coma or near coma- the goal of the research study is to promote health and not to hinder health care and therefore will not interfere with the admission of patients in need of critical care.

3.5 Sample size

Sample size calculation was based on the prevalence of diabetes in Zimbabwe of 9.7% which provided the most recent prevalence estimate was used (Mufunda et al., 20 06). The DM prevalence of 5.7% obtained in the meta-analysis by Mutowo and colleagues (2015) was not used as the data sources spanned a 45 year period. Since 1960, there has been enormous shifts in political, economic and social settings in Zimbabwe which influence the prevalence of DM, thus a more relevant prevalence statistic was used. Moreover, studies used in the meta-analysis had different diagnostic criteria for DM and heterogeneous sampling approaches. Ideally, the prevalence of T2DM would have been used for sample size calculation, but there is no data available. By assuming an error margin of 5% and a confidence level of 95%, a minimum sample size of 135 was obtained using the Dobson formula for cross-sectional studies (Charan and Biswas, 2013). By anticipating a non- response rate of 5% derived from a previous study (Mufunda et al., 2006), the total sample size was 142 participants.

3.6 Sampling procedure

A non - probability consecutive sampling was used to select patients as they attended the clinics. T2DM patients meeting the inclusion criteria were consecutively enrolled as they presented to Harare Central Hospital and Parirenyatwa Central Hospital between January 2017 and May 2018. The diabetic clinic at each hospital was held once a week.. This was the most appropriate sampling method as it allowed all patients to be screened for eligibility. Although

the technique has the disadvantage of being unrepresentative of the population, the utilisation of the only two referral public hospitals in Harare Central District may be able to capture a more representative sample as eligible participants will be from all areas of Harare and some were also referrals from outside the city. The hospitals serve as referrals for complicated cases as well as having an out-patient clinic that serves as a facility for routine monitoring of patients. Hospital outpatients, as well as inpatients, will be recruited as this increases the chances of accessing most patients from Harare.

3.7 Data Collection processing

Data collection techniques were as follows:

- Interviews [structured questionnaire (Appendix A)]
- Height measurements (measuring pole)
- Weight measurements (scale)
- Glycated haemoglobin tests (chemistry analyser)

Data collection was done by administering a structured questionnaire to obtain self-reported data on demographics and healthy lifestyle practices from the participants. Patients were enrolled into the study in the morning after receiving their health talks as they waited to be seen by the physician. A questionnaire was administered in a quiet environment without interruptions and as confidential as possible. Following the interview, an physical assessment of participant was performed to obtain weight and height measurements which were used to calculate body mass index (BMI). BMI is a measurement of a person's weight with respect to his or her height and acts as an indicator of a person's total body fat. It indicates whether one is underweight (BMI < 18.5), of normal weight (BMI between 18.5 and 24.9), overweight (BMI between 25 and29.9) or obese (BMI >30). A single weight and height measurement was performed by the study principal investigator or by the research assistant at each hospital site. Weight was measured using a calibrated scale (Taylor mechanical bathroom scale) (that was

utilised for all participants at one study area). The weighing scale did not require any zeroing before taking measurement. Participants were instructed to remove shoes and heavy outer clothing before being weighed. Height was measured using a wall mounted stadiometer (model not known) whilst the patient still had their shoes off. Thereafter, a blood sample from each participant was taken using a finger prick method for testing of HbA_{1C} levels. Blood samples were analysed onsite (using a rapid method) and patients were given their results. All samples were analysed from the same machine which was calibrated.

3.8 Data analysis

Data were entered onto Excel spreadsheet and exported to Stata version 12 for analysis. Descriptive statistics were used to describe the population, providing frequencies for categorical data and means reported with standard deviations for continuous data that were normally distributed or median if the continuous variable had a skewed distribution. Healthy lifestyle practices (high fiber-low carbohydrate diet, physical activity and non-smoking) were assessed as frequencies. A high fiber diet was measured qualitatively and subjectively as consuming vegetables as a large portion of main meals most of the time with five servings of fruit per day. **A** low carbohydrate diet was defined as consumption of un-refined carbohydrates in small quantities during main meals, snacking on non-carbohydrate based foods, taking less than one teaspoon of sugar with tea or coffee, drunk less than 3 times per day as well as not consuming fizzy drinks. A composite outcome variable of conforming to a healthy lifestyle was computed from conformity to recommended physical activity and low carbohydrate/ high fiber diet and non-smoking. A participant not conforming to a healthy lifestyle did not conform to either physical activity, low carbohydrate/ high fiber diet or smoked.

Chi-square test (or t-test for continuous data) was used to test for associations between lifestyle practices and patient demographics as well as associations between lifestyle practices and

HbA_{1C} levels. Statistical tests were performed at 95% level of confidence and 5% level of significance, that is, statistical significance was assumed with $p < 0.05$

3.9 Validity

Validity refers to accuracy, that is, the extent to which an instrument measures what it is supposed to measure (Turnock and Gibson, 2001). The questionnaire was translated to a local language (Shona) and back-translated to English by a different translator. A pilot study was done to assess content and construct validity of the data collection tools. Generally, ten minutes or less was spend in administering the questionnaire and participants were comfortable with that time, Two questions had to be adjusted as they were eliciting different ways of responding to the question. These were "What is your age?" which was adjusted to "What age were you on your last birthday?" The second one asked "Do you smoke?" and was split into two as follows, "Have you ever smoked?" and "Do you currently smoke?", Weighing scales and the chemical analyzer for testing HbA_{1C} were calibrated to ensure accurate data was obtained. Data was double entered to ensure accuracy by quickly identifying errors and resolving them.

3.10 Reliability

Reliability refers to reproducibility, that is, how reliable a tool is in producing the same results in deferent settings if nothing changes (Turnock and Gibson, 2001). Data collection was done using a standardized and structured questionnaire in order to ensure uniformity in data collection. Two research assistants were trained prior to study commencement to administer the questionnaire. Intra-observer variability was assessed which resulted in little variability. Therefore, no adjustments were necessary to the questionnaire. HbA_{1C} was measured using standard operating procedures and kit insert from the manufacturer. The testing device was also calibrated and controls used as quality control.

3.11 Generalizability

The study results cannot be generalised to all T2DM patients aged 18 years and older. This finding was done in an urban setup and findings may be different when the set-up is rural due to differences in food access, dietary patterns as well as differential transport system. Additionally, people are different and will always possess different personal drive and motivation to adopt a healthy lifestyle.

3.12 Ethical Considerations

Before conducting this study, ethical approval was sought from and approved by the University of the Western Cape ethical committee (Appendix D) and the Medical Research Council of Zimbabwe which governs all research involving human subjects in the country (Appendix E).. Permission to conduct the study at the study sites was obtained from Harare and Parirenyatwa hospitals (Appendices F and G, respectively) to conduct the study in Zimbabwe

Informed written consent (Appendices B and C) was obtained from all participants. All participants entered the study voluntarily. Each participant had the freedom to withdraw from the study at any point during the study without prejudice to treatment access. Patient information was kept confidential using a coding system. Their files were kept in locked cupboard and data on the computer was accessed through a password

3.13 Limitations of the study

Most of the data were obtained from participants through self reports on their healthy living practices. They were potentially most likely to report what is expected rather than what they were actively doing hence producing bias in the positive direction. There was also potential for recall bias as participants had to remember what activities they did in the past and for how long. A consecutive sample was used on patients attending a diabetic clinic which may not

have been representative of the population of type 2 diabetic patients in Harare. Caution should be taken when generalising results due to this selection bias.

CHAPTER FOUR: RESULTS

4.1 Introduction

This chapter presents the findings obtained from analysing data that was collected from adult respondents through an interviewer guided questionnaire, anthropometric measurements and testing of HBA_{1C} levels. Demographic characteristics of respondents are first presented as frequencies. Frequencies are then tabulated according to respondents' practices with regard to dietary, physical activity, smoking and alcohol intake behaviors. Finally, associations of demographics and HBA_{1C} levels to a comprehensive outcome of conforming to a healthy lifestyle are presented.

4.2 Demographics characteristics

A total of 163 individuals were invited to enter the study of which 158 (96.9%) consented to participate in the study. Of the 158 consenting participants, 150 (94.9%) had complete data or almost complete data and eight (5.1%) had a lot of missing data including HBA_{1C} levels. The eight participants with a lot of missing data were excluded from analysis resulting in data from 150 participants being analysed.

4.2.1 Sex, age and marital status and religion

Of these 150 participants, 67 (44.7%) were males whilst 83 (55.3%) were females. The age distribution ranged from 28 to 84 years with a median age of 54 years (IQR; 45 – 65). Figure 3 below shows that the majority of participants were older than 61 years whilst those aged less than 40 years were few.

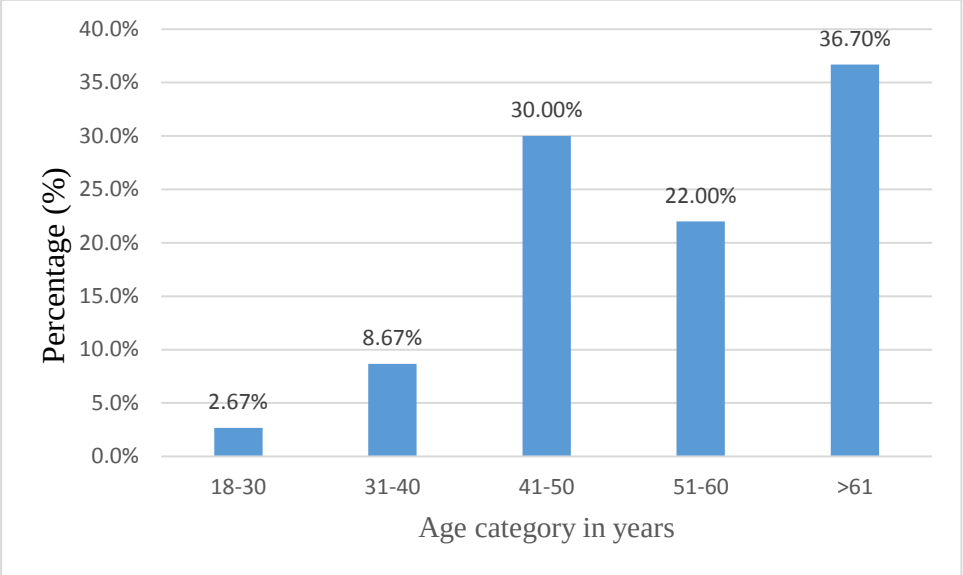


Figure 3: The distribution of participants by age (n=150)

Most (66.7%) of the participants were married followed by those who were widowed (19.33%). Only one (0.7%) participant was cohabiting (Figure 4). The main religion was Christianity (96.0%) with 1.3% being Muslims, Hinduism (0%), Buddhism (0%) and the rest (2.7%) professing other religions.

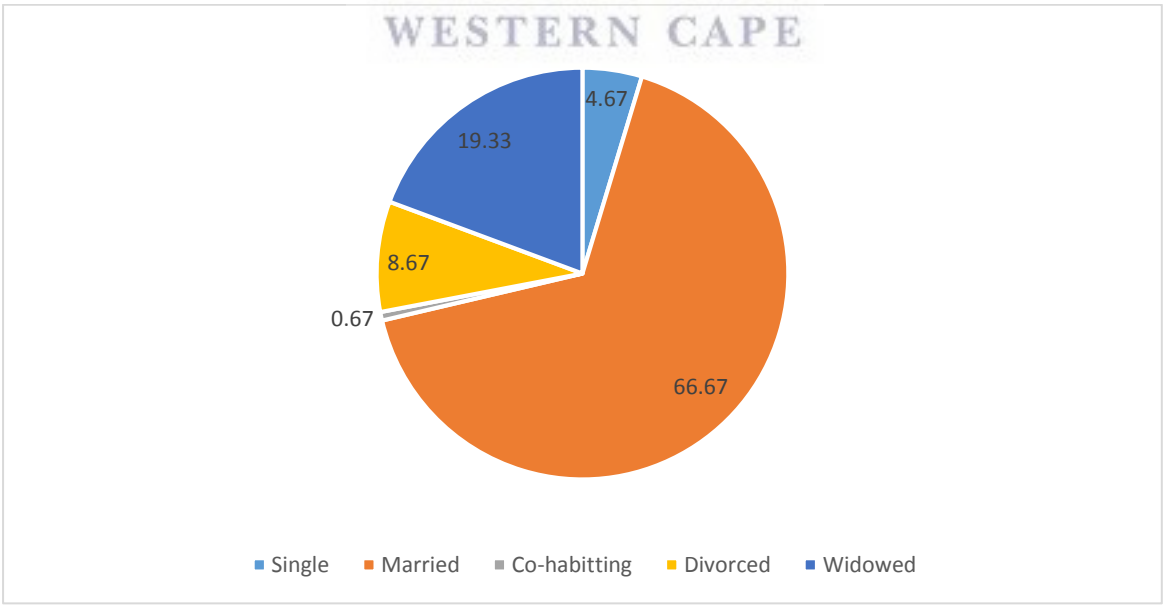


Figure 4: The distribution of participants by marital status (n=150)

4.2.2 Body Mass Index (BMI)

The average BMI of the participants was 27.2kg/m^2 (SD3.7). The least calculated BMI was 16.8kg/m^2 whilst the highest was 36.4kg/m^2. Most (n = 78; 52.0%) of the participants were overweight with a BMI greater or equal to 25 and less than 30kg/m^2 (Figure 5). Figure 5 also shows that two (1.3%), 39 (26.0%) and 31 (20.7%) were underweight, normal weight and obese, respectively.

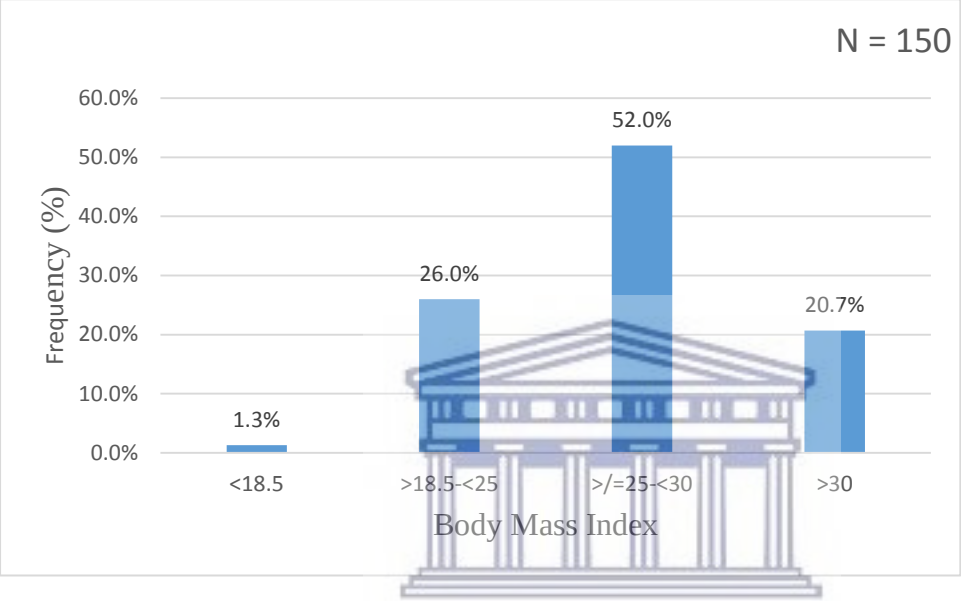


Figure 5: The distribution of participants according to body mass index category

4.2.3 Level of education, employment status and income

Seven (4.67%) participants had never received any formal education whilst 117 (78%) had received at least secondary education (Figure 6).

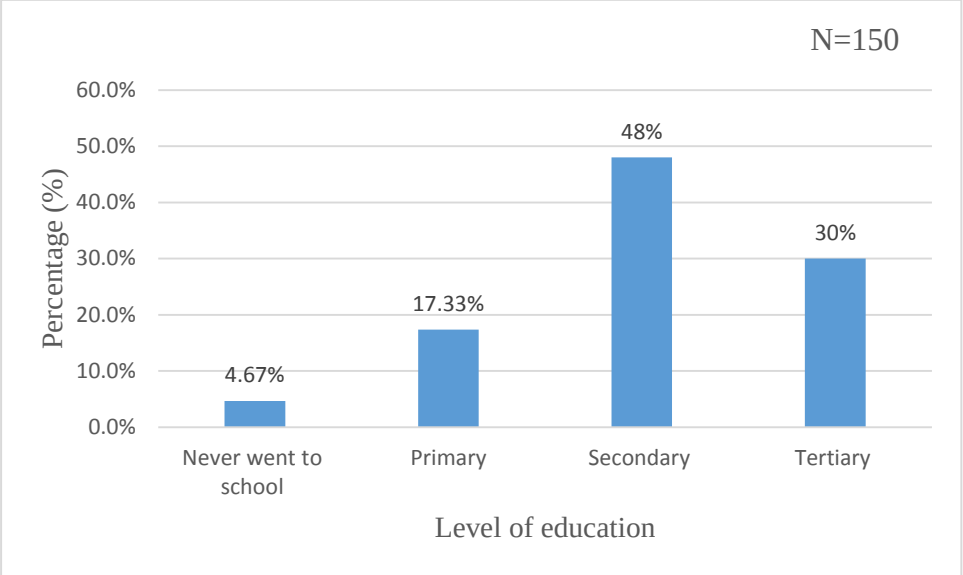


Figure 6: The distribution of participants by level of education

A total of 48 (32%), 44 (29.3%), 37 (24.7%) 20 (13.3%) and 1 (0.7%) participants were formally employed, self-employed, unemployed, pensioners and informally employed on part-time basis, respectively (Table 1). Forty participants including one self-employed, 36 unemployed and 3 pensioners indicated that they did not have any monthly income (Table 1).

Table 1: The frequencies of employment status against monthly income among participants

		Monthly income range (US$)					
		None n (%)	<300 n (%)	300-500 n (%)	501-1000 n (%)	>1000 n (%)	Total frequency
Employment Status	Formal	0 (0.0)	0 (0.0)	9 (18.8)	35 (72.9)	4 (8.3)	48
	Self	1 (2.3)	6 (13.6)	28 (63,6)	8 (18.2)	1 (2.3)	44
	Unemployed	36 (97.3)	1 (2.7)	0 (0.0)	0 (0.0)	0 (0.0)	37
	Pensioner	3 (15.0)	2 (10.0)	14 (70.0)	1 (5.0)	0 (0.0)	20
	Student	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0
	Other	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	1
	Total frequency	40 (26.7)	10 (6.7)	51 (34.0)	44 (29.3)	5 (33.3)	150

% are row percentages

4.3 Access to diabetes care

Of the 150 participants with a diagnosis of T2DM over a range of 2 months to 20 years [median duration of diagnosis 5 years (IQR: 3 – 8)], only one (0.67%) participant had never received any information on diabetes care. Among those that received information on diabetes care, their sources are tabulated below in Table 2. A total of 147 (98.7%) out of 150 participants receive health education when they report for their monthly routine check- up visits. Of the 147 participants who received health education, 109 (74.2%), 34 (23.1%) and 4 (2.7%) always,

sometimes and never understand the information given to them, respectively. One hundred and forty one out of the 147 participants (95.9%) reported that they are given the opportunity to ask questions. A few (n=19; 12.7%) participants were members of the Diabetes Association of Zimbabwe of whom 7 (36.9%), 10 (52.6%) and 2 (10.5%) attended meetings rarely, sometimes and most of the times, respectively.

Table 2: The distribution of participants according to the source of information on diabetes care (n=149)

Source of diabetes care information	Yes n (%)	No n (%)
Nurse	127 (85.2)	22 (14.8)
Doctor	75 (50.3)	74 (44.7)
Diabetes association of Zimbabwe	8 (5.4)	141 (94.6)
Media	9 (6)	140 (94)
Family	10 (6.7)	139 (93.3)
Friends	7 (4.7)	142 (95.3)
Dietician	11 (7.4)	138 (92.6)

4.4 Adherence to treatment

A total of 70 (50.0%), 42 (28.2%) and 37 (24.8%) participants were on oral hypoglycaemic drugs only, insulin only and both insulin and oral hypoglycaemic therapies, respectively. Out of the 149 participants, 135 (90.6%) reported that they always take their medication as prescribed. Table 3 shows the self-reported treatment adherence behaviours of the participants.

Table 3: The distribution of participants according to self - reports on always being able to take prescribed medicines

Treatment regimen	Always take medication		
	Yes n (%)	No n (%)	Total
Insulin only	34 (81.0)	8 (19.0)	42
Oral hypoglycaemic drugs only	66 (94.3)	4 (5.7)	70
Both insulin and oral hypoglycaemic drugs	35 (94.6)	2 (5.4)	37
Total	135 (90.6)	14 (90.4)	*149

- One participant has missing data

4.5 Diabetes related complications

Eighty six (57.7%) participants reported diabetes related complications whilst 43 (28.9%) had none and 20 (13.4%) did not know if they had any complication. Among those that had complications, the frequencies of the complications are shown in Figure 7.

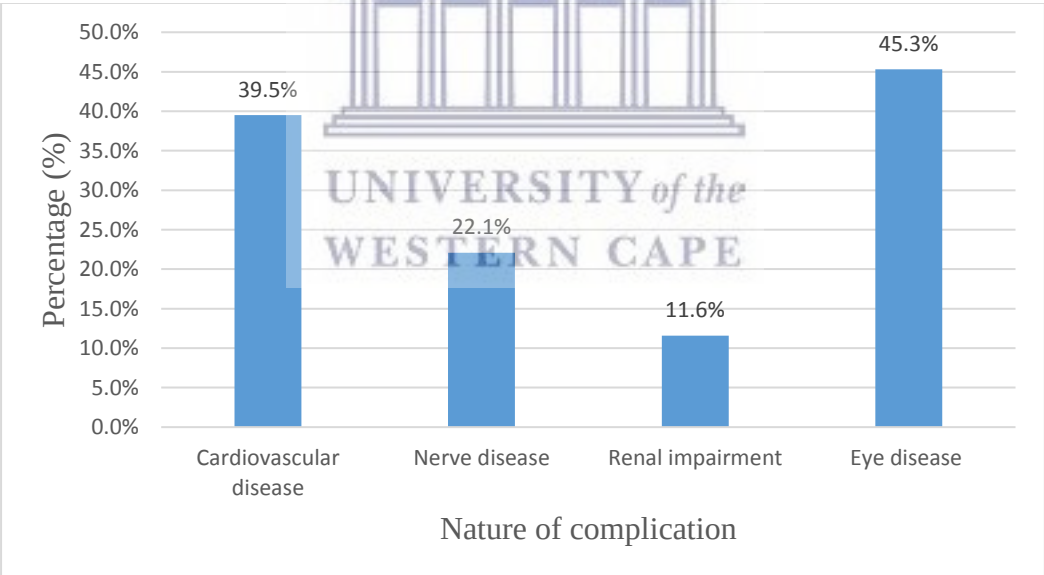


Figure 7: The distribution of complications among participants (n=86)

4.6 Healthy lifestyle behaviors

4.6.1 Physical activity

Physical activity at work (formal work, self-employment or household work)

A total of 41 (27.5%) and 96 (64.4%) participants out of 149 participants performed vigorous intensity physical activity at work (such as carrying or lifting heavy loads, or construction work or digging) and moderate intensity physical activity at work (such as carrying light loads, brisk walking for at least 10 mins continuously) as part of their usual work (Table 4). Thirty-eight (25.5%) participants were involved in both vigorous and moderate intensity work related activities and fifty (33.6%) participants did not engage in any vigorous or moderate intensity physical activities at work. For participants involved in vigorous intensity work the median time in a week used in the work was 195 minutes (Inter-quartile range 80-360) whilst in participants performing moderate intensity work, the weekly median time was 120 (IQR 90-160).

Table 4*:* The distribution of participants according to the intensity of physical activity undertaken at work

Intensity of activity at work	Frequency	(%)
Vigorous only	3	2.0
Moderate only	58	38.9
Both vigorous and moderate	38	25.5
Non vigorous or moderate	50	33.6
Total	*149	100

Recreational physical activity

As shown in Table 5, out of 149 participants, a total of 29 (19.4%) undertook vigorous intensity exercises such as playing football or running for at least 10 minutes continuously. The median time consumed in these activities per week was 75 minutes (IQR 60 – 120). A total of 18

(12.1%) out of 149 participants performed moderate intensity exercises such as very brisk walking, cycling or playing volleyball and the weekly median time used in these activities was 105 minutes (IQR 60 – 150). Table 5 shows the frequencies according to intensity of exercises.

Eighteen (12.1%) and 48 (32.2%) out of 149 participants claimed to have gym facilities and recreational grounds, respectively, in their area of residence (Figure 8). Six (4.0%) participants had gym facilities only, 36 (24.2%) had recreational grounds only 12 (8.1%) had both gym facilities and recreational grounds and 95 (63.7%) had neither gym facilities nor recreational grounds (Figure 8). Only 27 (50.0%) of the 54 participants with either gym facilities or recreational grounds in their area of residence reported that they sometimes use the available local facilities.

Table 5: The distribution of participants according to the intensity of recreational exercises during leisure time

Intensity of activity at during recreation	**Frequency**	**(%)**
Vigorous only	17	11.4
Moderate only	6	4.0
Both vigorous and moderate	12	8.1
Non vigorous or moderate	114	76.5
Total	*149	100

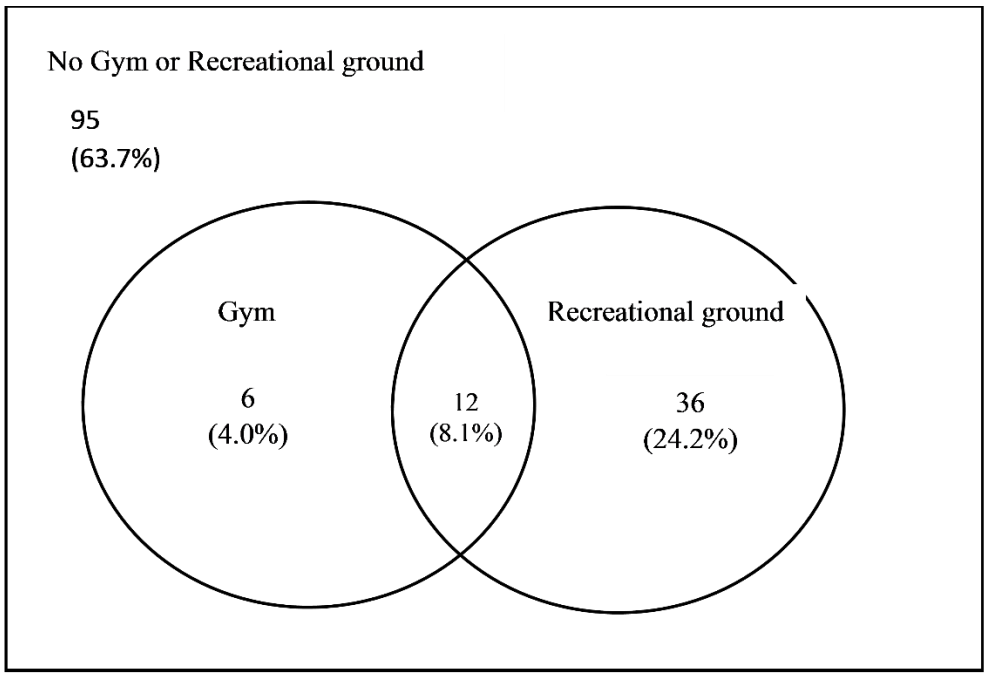


Figure 8: The availability of infrastructure for physical activity for participants (n=149)

Overall, the number of participants who performed moderate to vigorous intensity activity (both at work and during recreational activities) were 106 (71.1%) out of 149 participants. Sixty one (57.5%) out of 106 showed that they achieve the recommended 150 minutes per week.

Preferred mode of travel

Figure 9 illustrates the preferred mode of travel by participants for different distances. A total of 132 (88.6%) and 115 (77.2%) out of 149 participants prefer to walk for distances less than 500m and between 500m and 1km, respectively. For distances less than 2km, participants preferred to walk, whist they preferred to use public transport for distances greater than 2km (Figure 9). The preference for car and public transport was 95 (63.8%), 132 (88.6%) and139 (93.3%) for 2 - 5km, 5 – 10km and greater than 10km distances, respectively.

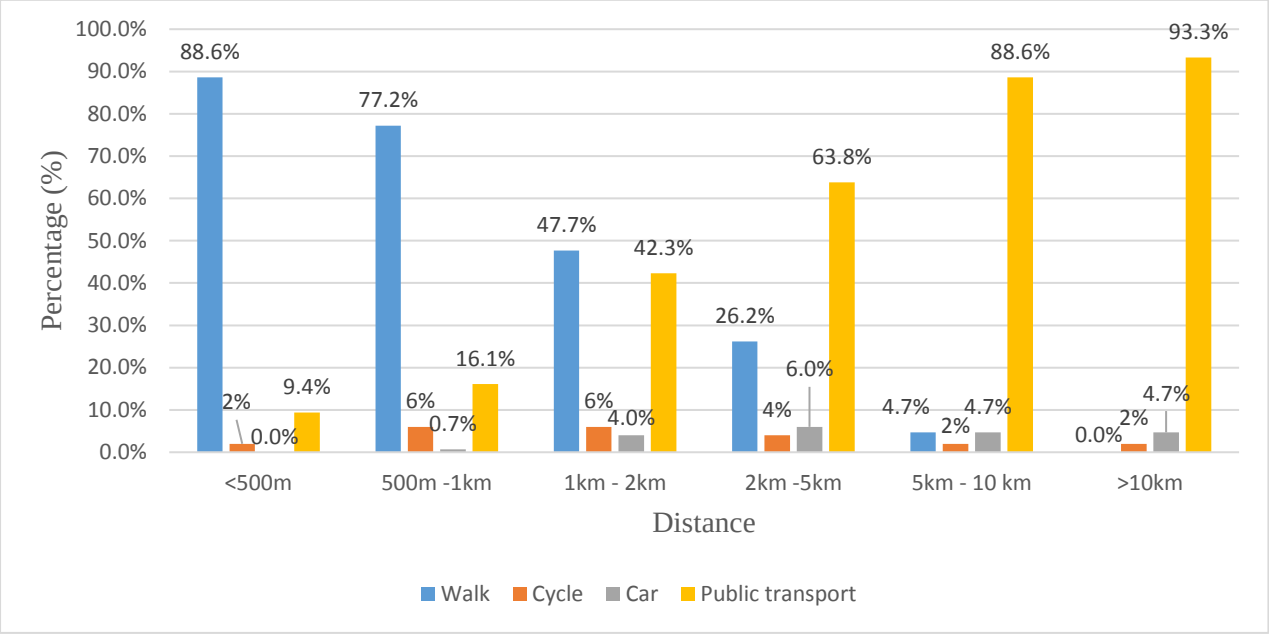


Figure 9: The distribution of participants according to a preferred mode of transport for different distances (n=149)

4.6.2 Diet

Figure 10 illustrates the meal constituents that usually make the largest portion of their meal. A total of 112 (75.2%), 90 (60.4%), 19 (12.8%) and 1 (0.7%) out of 150 participants reported that their largest meal was usually composed of the following carbohydrates, vegetables, meat/dairy products and fruits respectively (Figure 10). Amongst the 150 participants, 101 (67.8%) reported that they use unrefined mealie meal based products as their main source of carbohydrate compared to 48 (32.2%) that used refined based products. Overall, participants consumed an average of two fruits (SD 1.4) per day with 99 (66.0%) consuming less than 5 servings of fruits and vegetables. In between meals, participants snacked a median of two times (IQR 1 -2), with 49 (33.8%) participants snacking on fruits. For a beverage, most (n= 123; 82.6%) participants consumed tea followed by coffee (n = 12; 8.1%) and fizzy drink (n = 4; 2.7%).

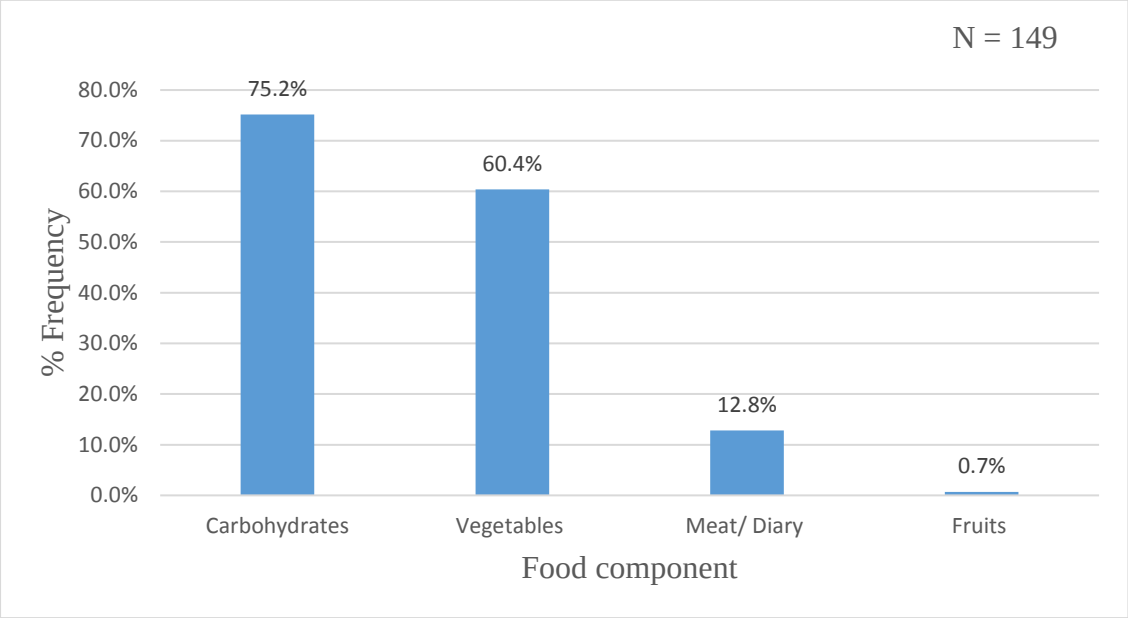


Figure 10: The distribution of participants according to participants' largest food components portion for their usual meals

Among participants that consumed tea or coffee an average of half a teaspoon of sugar was added to a standard tea of coffee mug.

A composite variable of conformity to a healthy diet was computed using food component making up the largest portion of usual meals, refined or unrefined source of carbohydrate and number of fruit servings per day. It was observed that 100 (66.7%) out of 150 participants were conforming to a healthy diet and 50 (33.3%) were not (Figure 11).

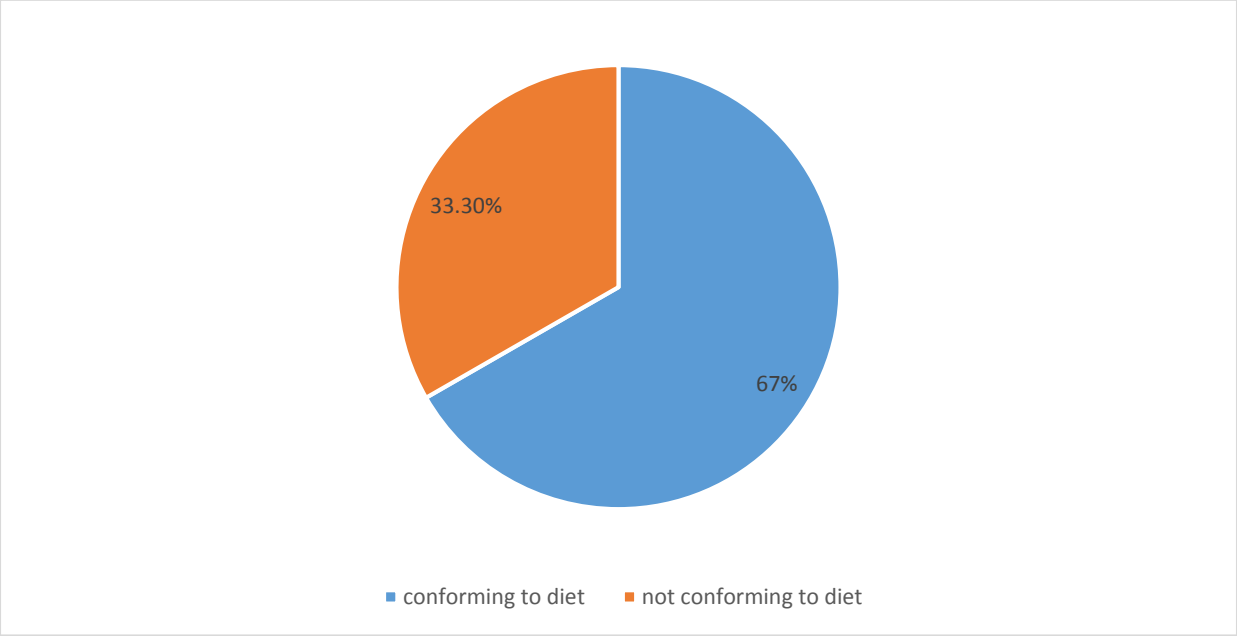


Figure 11: The distribution of participants according to conformity to diet (n=150)

4.6.3 Alcohol intake

As shown in figure 12, 15 (10.0%) out of 150 participants were currently consuming alcoholic drinks at the time of the study. The average consumption rate was 2000mls (SD 600) per week

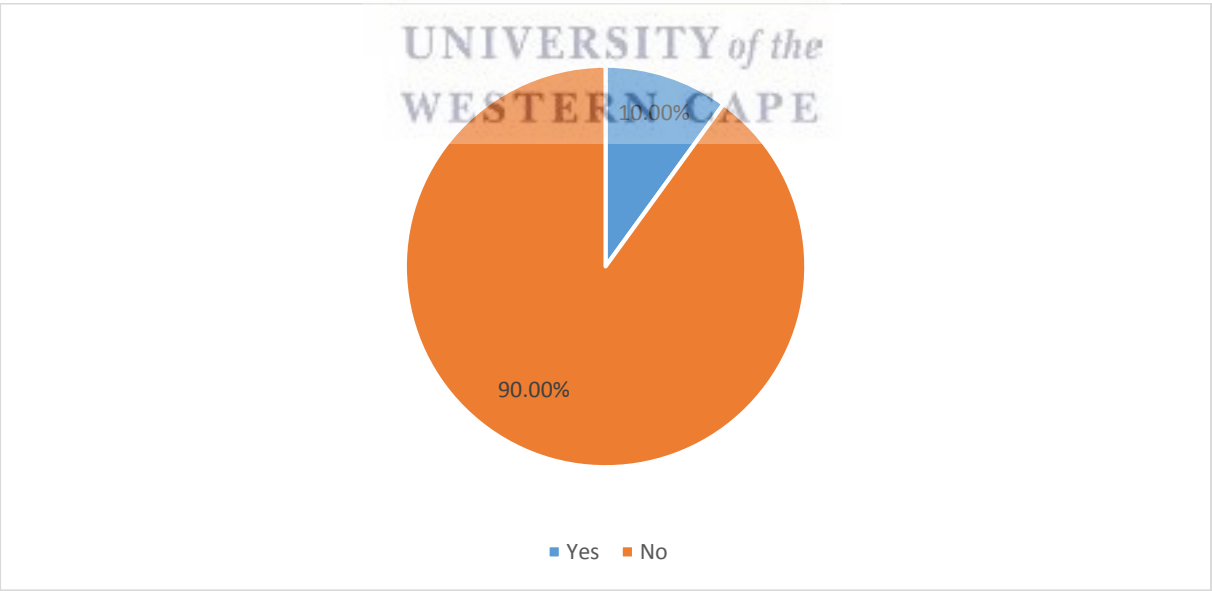


Figure 12: Alcohol intake among study participants (n=150)

4.6.4 Smoking

Twenty one (14%) of 150 participants indicated that they had ever smoked in their life (Figure 13). There were no current smokers in the study, that is, all the participant were non-smokers.

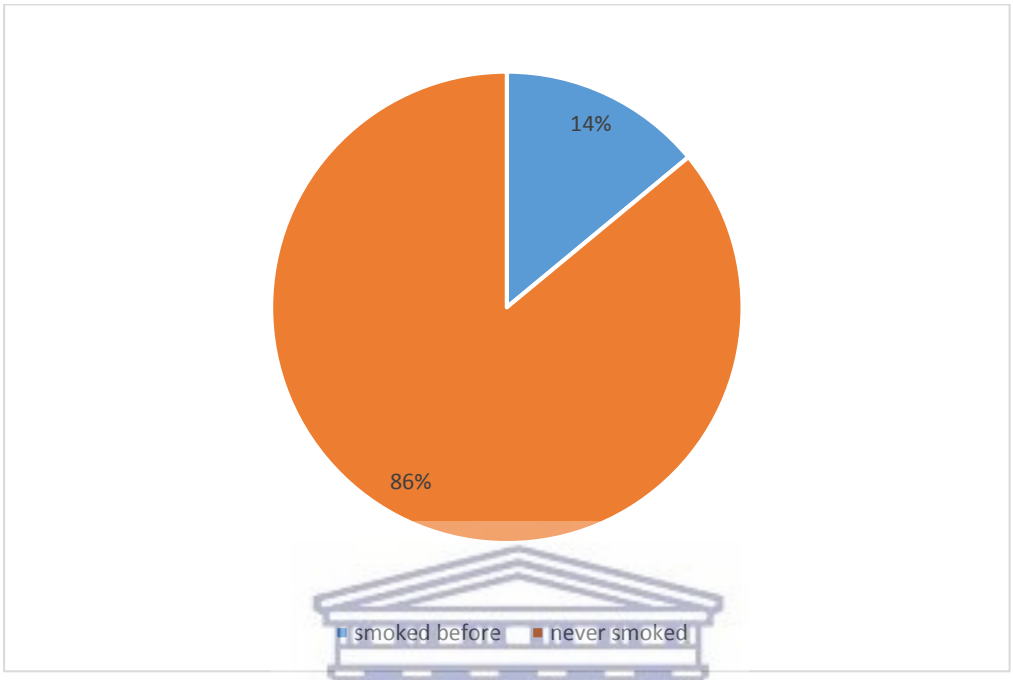


Figure 13: Distribution of participants according to past smoking behaviour

4.7 Glycated haemoglobin levels

Among the participants, glycated haemoglobin (HbA_{1C}) levels ranged from 5.6% to 11.8%. The average value was 7.6% (SD: 1.3%). There were 93 (62.0%) participants with HbA_{1C} levels below 7% and 57 (38.0%) with values equal to or more than 7% (Figure 14).

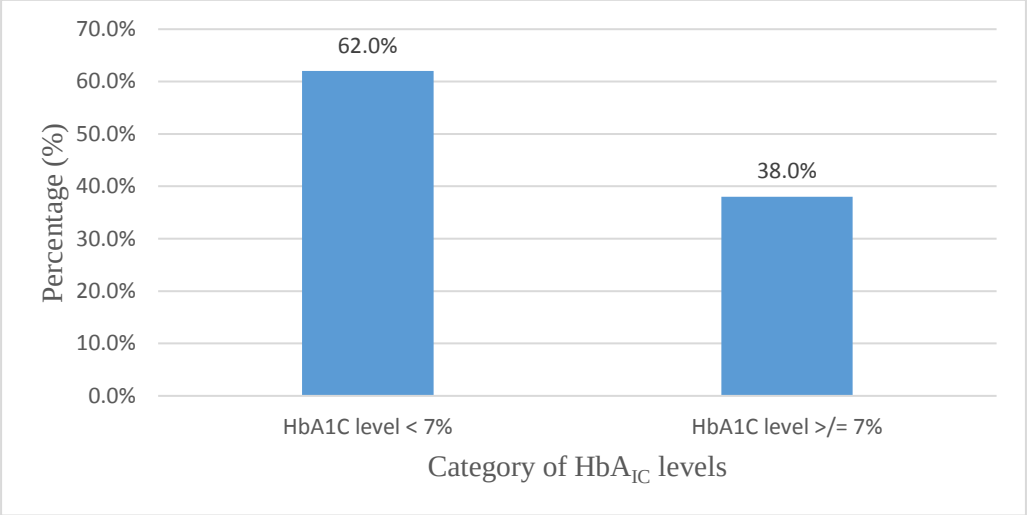


Figure 14: The distribution of participants according to categories of low (<7%) and high (>/= 7%) HBA$_{IC}$ levels

4.8 Healthy lifestyle

Table 6 shows the number and percentage frequency of participants that were conforming to different aspects of a healthy lifestyle. A total of 35 participants were conforming to both physical activity and diet. Overall, 35 (23.5%) participants were conforming to a healthy lifestyle whilst 114 (76.5%) were not.

Table 6: The distribution of participants by conformity status to components of a healthy lifestyle

		Conforming n (%)	Not conforming n (%)	Total
Healthy lifestyle component	Physical activity	61 (40.9)	88 (59.1)	*149
	Diet	100 (66.7)	50 (33.3)	150
	Non smoking	150 (100)	0 (0.0)	150
	Overall healthy lifestyle	35 (23.5)	114 (76.5)	*149

- One participant missing data

4.8.1 Association between healthy lifestyle component and HbA_{1C} levels

Only diet as a component of a healthy lifestyle was significantly associated with a healthy lifestyle. Table 7 shows that participants conforming to a low carbohydrate, high fiber diet had significantly lower than 7% HbA_{1C} levels than those not conforming (p = 0.004).

Table 7: Association between healthy lifestyle component and HBA_{1C} levels

Healthy lifestyle component	HBA_{1C} <7% n (%)	HBA_{1C}>/=7% n (%)	Total n(%)	P value
Physical activity				
Conforming	42 (68.9)	19 (31.1)	61	0.178
Non-conforming	51 (58.0)	37 (42.0)	88	
Diet				
Conforming	54 (54.0)	46 (46.0)	100	**0.004**
Non-conforming	39 (78.0)	11 (22.0)	50	
Smoking				
Smokers	0 (0)	0 (0)	0	no value
Non smokers	93 (62.0)	57 (38.0)	150	

4.8.2 Associations of a healthy lifestyle to demographics and HBA_{1C}

There were 25 (30.5%) out of 82 women who were conforming to a healthy lifestyle compared to 10 (14.9%) out of 67 men. More females conformed to a healthy lifestyle compared to their male counterparts (p = 0.026). A statistically significant difference (p = 0.003) was also observed in the number of participants conforming to a healthy lifestyle and understanding of health education provided. Similarly, the observed difference in frequency of diabetes associated complications between participants conforming and not conforming to a healthy lifestyle was statistically significant (p = 0.002). Participants who did not conform to a healthy lifestyle had significantly more complications than those that conformed. No statistically significant differences were observed for the categories of HbA_{1C} as well as the remaining demographics tabulated in Table 8.

Table 8: Association of healthy lifestyle practices with participant demographics and HbA_{1C} (n=149)

Characteristic	Non – conforming n (%)	Conforming n (%)n (%)	Total	P value
Gender				
Females	57 (69.5)	25 (30.5)	82	0.026
Males	57 (85.1)	10 (14.9)	67	
Age category, years				
less or equal to 30	2 (50.0)	2 (50.0)	4	0.606
31 – 40	10 (76.9)	3 (23.1)	13	
41 – 50	33 (73.3)	12 (26.7)	45	
51 – 60	24 (81.8)	8 (18.2)	32	
greater or equal to 61	45 (76.5)	10 (23.5)	55	
Body mass index, kg/m2				
<18.5	2 (100)	2 (100)	2	0.592
>/=18.5- <25	32 (82.0)	32 (82.0)	39	
>/=25-<30	56 (72.7)	56 (72.7)	77	
>/=30	24 (77.4)	24 (77.4)	31	
Income, $				
<100	35 (87.5)	5 (12.5)	40	0.108
100-300	5 (50.0)	5 (50.0)	10	
301-500	39 (78.0)	11 (22.0)	50	
5001-1000	31 (70.5)	13 29.5)	44	

>1000	4 (80.0)	1 (20.0)	5	
Marital status				
Single	4 (57.1)	3 (42.9)	7	0.594
Married	76 (76.8)	23 (23.2)	99	
Co-habiting	1 (100.0)	0 (0.0)	1	
Divorced	9 (69.2)	4 (30.8)	13	
Widowed	24 (82.8)	5 (17.2)	29	
Level of education				0.149
Never went to school	7 (100.0)	0 (0.0)	7	
Primary	23 (88.5)	3 (11.5)	26	
Secondary	51 (71.8)	20 (28.2)	71	
Tertiary	33 (73.3)	12 (26.7)	45	
Employment status				0.405
Formal	35 (74.5)	12 (25.5)	47	
Self-employed	30 (68.2)	14 (31.8)	44	
Unemployed	31 ((83.8)	6 (16.2)	37	
Pensioner	17 (85.0)	3 (15.00	20	
Student	0 (0.0)	0 (0.0)	0	
Part time	1 (100.0)	0 (0.0)	1	
***Duration of T2DM,years** Less than 1	12 (92.3)	1 (7.7)	13	0.586
1-5	50 (76.9)	15 23.1)	65	
6 -10	34 (70.8)	14 (28.2)	48	
11-15	12 (75.0)	4 (25.0)	16	
16-20	5 (83.3)	1 (16.7)	6	
^Understand health education provided				
Yes	88 (80.7)	21 (19.3)	109	0.003
Sometimes	23 (69.7)	10 (30.3)	33	
No	0 (0.0)	3 (100.0)	3	
***Diabetes related complications**				
Yes	73 (84.9)	13 (15.1)	86	
No	24 (57.1)	18 (42.8)	42	0.002
Don't Know	16 (80.0)	4 (20.0)	20	
HbA1C levels				
Less than 7	41 (73.2)	15 (26.8)	56	0.461
Greater or equal to 7	73 (75.5)	20 (21.5)	93	

- * = Missing data on one participant; ^ = missing data on two participants

4.9 Challenges in adopting a healthy lifestyle

Out of 150 participants, 94 (62.7%) indicated that they faced challenges in adopting a comprehensive healthy lifestyle compared to 56 (37.3%) who had no challenges. The challenges faced by the 94 participants included lack of money, adequate food, time, support, self-motivation, recreational facilities and understanding as well as the presence of complications, long distances to a health care facility and forgetfulness. These challenges are tabulated along with their frequencies in Table 9.

Table 9: Challenges that are faced by T2DM patients in conforming to a healthy lifestyle

		Frequency	%
Nature of challenge	Lack of adequate money	43	45.7
	Lack of support	42	44.7
	Lack of self-motivation	16	17.0
	Health facility too far	13	13.8
	Lack of time	7	7.4
	Lack of recreational facilities	6	6.4
	Inability due to non-diabetes related complications	4	4.3
	Inability due to diabetes related complications	3	3.2
	Lack of self-control	1	1.1
	Lack of understanding the importance of healthy living	1	1.1
	Lack of adequate food	1	1.1
	Forgetfulness	1	1.1

- One participant has missing data; Categories are mutually inclusive

CHAPTER FIVE: DISCUSSION

5.1 Introduction

This chapter discusses the main findings of the study in relation to literature and the study objectives. The objective of this study was to describe the lifestyle practices of T2DM patients and determine if they conform to healthy practices. In addition, the study aimed to correlate healthy lifestyle practices with HbA_{1C} levels.

5.2 Demographics

There were more female participants than male participants in the study with most of the participants aged 61 years or older. The age distribution of participants in the study is in accordance with those observed worldwide where most people living with diabetes are aged 65 years or more (IDF, 2017). Similarly there was no difference (p=0.364) in age distribution of participants enrolled at Harare Central hospital (n =77) and those enrolled at Parirenyatwa Central hospital (n=71). A few of the participants were younger than 30 years.

Most of the participants had at least a secondary level education. However, only 48 (32.2%) were formally employed. The reported employment rate among the economically active adult population in Zimbabwe was 94% in 2017, while the unemployed adult population mainly comprised of students, the elderly and the sick (ZIMSTAT, 2017). The low numbers of participants being formally employed may be due to the relatively older study population as well as the increased job retrenchments that have been occurring in Zimbabwe. Most of the participants that were formally employed were earning $300 to $1000. An almost equal number (44; 29.5%) to those formally employed were self- employed with most earning between $300 and $500. The proportion of self-employed participants in the study was relatively higher compared to the reported proportion of the self-employed population in

Zimbabwe, reported to be 14% in 2017 (ZIMSTAT, 2017). The reason for the higher proportion of self-employed participants in the study may be due to the elderly population being pensioners or retrenched workers looking for sources of self- generated income.

5.3 Body Mass Index

Most of the participants in the study were overweight. In contrast, DM patients in South Africa were obese with mean BMI score of 32kg/m^2 for patients with uncontrolled DM and 29kg/m^2 for patients with controlled DM (Adeniyi et al., 2016). In a review on obesity and diabetes prevalence in Africa, South African patients were found to have high BMI scores similar to those of Arabian countries in North Africa (NCD Risk Factor Collaboration- Africa Working Group, 2016). Other African countries had normal to slightly above normal BMI scores among patients. A number of overweight patients observed in this study may indicate an epidemiological transition towards obesity due to changing lifestyle practices. Overweight participants in the study may be explained by a large number of participants who did not conform to the recommended moderate to vigorous intensity physical activity of at least 150 minutes per week. Regular physical activity is encouraged for T2DM patients in order that they maintain a lean weight and reduce abdominal obesity which facilitates insulin resistance (Yaturu, 2011). Similar findings were obtained from a study in Harare which described factors related to non-adherence to a healthy lifestyle among T2DM patients (Mukonka et al., 2016). In their study to determine characteristics associated with T2DM, Danquah and colleagues (2012) found that 53% of 1446 T2DM patients were overweight.

5.4 Access to diabetes care

Almost all the study participants received health education on diabetes including diabetes care. Most of the health education came from nurses followed by doctors while the Diabetes Association of Zimbabwe were the source of diabetes health education to a small number of

participants. These findings are similar to those of Redmond and colleagues (2010) whose study sought to examine if interpersonal versus mass media sources of health information are related to meeting recommendations for health behaviour and cancer screening. In their study, they found an association between the use of healthcare providers for health information and meeting recommendations for health behaviours. Notably, very few participants belonged to the Diabetes Association of Zimbabwe. It was observed that most of the participants were unaware of the existence of the association. Such unawareness may be attributed to the lack of awareness campaigns by the association and the passive role of the association in the management of DM.

The high number of participants who always understood the health education they received during routine visits positively reflects on the quality of health education that the participants receive. However, a study in Taiwan found that there are different perspectives for health education needs between diabetes patients and nurses (Wu et al., 2014). Nurses perceived there was a greater need for health education while patients did not. Moreover, patients saw themselves as more competent at completing self-care tasks while nurses disagreed with this notion (Wu et al., 2014). Given these perceptions, it is likely that participants in this study may also regard themselves as always understanding health education on diabetes but not competent in successfully implementing diabetes self-health care.

5.5 Treatment adherence and complications

Most of the participants reported that they always remember to take their medication. Despite the increased adherence reported in the study, there were 86 (57.7%) participants with diabetes related complications. There has been a suggested dual relationship between treatment adherence and conforming to a healthy quality of life among patients with respiratory disease (Agh et al., 2015). The authors concluded that the effect of treatment adherence on quality of

life may be positive due to the effectiveness of therapy with reduced complications or negative due to the negative effects of therapeutic side effects resulting in increased complications. The high proportion of complications in this study may be explained by the fact that T2DM is a gradually progressing disorder which will result in the onset of complications with increasing age. Studies have also shown a high prevalence of T2DM complications among patients in Zimbabwe (Saravoye, 2014; Mafuratidze et al., 2014). The most commonly reported diabetes related complications in this study were eye disease, and cardiovascular disease while in the study by Saravoye, (2014) among similarly aged T2DM patients at Parirenyatwa hospital, nerve disease and eye disease were common complications while cardiovascular diseases were not. Similarly, Mukonka et al., (2016) observed eye and nerve disease to be more common complications among T2DM patients. These findings of high complication rates in relatively older patients concur with the natural sequelae of T2DM.

5.6 Lifestyle behaviors

5.6.1 Physical activity

In this study, it was observed that moderate to vigorous activity was performed by some participants whose work/ employment involved duties such as construction work and digging. The majority of participants did not take part in any moderate to vigorous activities at all. Very few participants indulged in moderate to physical activities such as running or playing football, during their recreational/ leisure time. Dutton and colleagues (2005) investigated the potential barriers to physical activity among T2DM African- American patients. In their study, they found that many barriers were more related to patients' medical conditions (such as joint pain, the presence of complications) than environmental barriers commonly associated with a low income setting (such as lack of recreational grounds). They also suggested that internal barriers, such as self-efficacy or motivation, play a larger role than environmental barriers.

In addition, globalisation has promoted mechanisation, which in turn has promoted a more sedentary way of living (Hu, et al., 2011). Studies have depicted the dominating presence of sedentary behavior and light intensity activities during waking hours (Tudor-Locke et al., 2011; Ng and Popkin, 2012). Additionally, the lack of facilities in most residential places of the participants may encourage a sedentary way of living.

For those participants that participated in any form of moderate to vigorous physical activity, only a few conformed to the required total time of 150 minutes. This study finding on physical activity behavior correlates with those of T2DM patients in Ghana where 21.4% of 187 study participants performed physical exercises daily (Mogre et al., 2017). Interestingly diabetes patients who were 60 years or older had similar physical activity, as measured by total activity counts using an accelerometer, compared to pre-diabetic patients and healthy controls (Steeves et al., 2015). Likewise, no significant change in walking, moderate to vigorous physical activity and fruit and vegetable consumption was noted in newly diagnosed T2DM patients in Australia (Chong et al., 2017). It is apparent from the results that not many patients willfully decide to adopt a lifestyle that involves physical activities.

Generally, most participants preferred to walk when distances were less than 2km long and to use cars or public transport when distances were longer than 2km. Very few participants used cycling as a form of transportation. Despite many participants walking over short distances in this study, further analysis of walking could not be done without knowing the intensity and total time of walking involved. According to recommendations, walking should be at least for 150 minutes per week (ADA, 2008; DPP, 20002). Furthermore walking has to be brisk to be beneficial (Joseph et al., 2016).

As concluded in a meta-analysis study on changing physical activity behaviour in T2DM patients, behaviour change techniques are required to ensure that patients practice physical

activity exercises as a lifestyle. Such techniques include prompting participants to set goals, self-monitoring of progress, conducting follow-up discussions and telephone calls, and opportunities for participants to review the effect of increased physical activity on blood glucose levels (Avery et al., 2012). Furthermore, motivating adults with T2DM to remain physically active beyond interventional programs requires ongoing monitoring and encouragement (Casey et al., 2010).

5.6.2 Diet

In this study, participants' large portions of their main meals comprised of carbohydrates and vegetables with relatively less fruit and meat. Their carbohydrate source was mainly unrefined mealie-meal based food. The intake of unrefined food is in line with the dietary recommendation of consuming foods with a low glycaemic load for T2DM patients. However, participants had on average two servings of fruit and vegetables per day which is much less than the recommended five servings of fruit and vegetables per day. A study in Ghana showed that in a comparable population of elderly T2DM, their dietary pattern tended to be of traditional foods such as fermented maize products and participants tended to be overweight possibly due to the high glycaemic load of their foods (Frank et al., 2014). Overall, a substantial number of participants (67.0%) conformed to healthy meals. In contrast with these study findings, only 29.9% of 187 T2DM patients in Ghana were able to eat healthily while in Chinese Americans, adherence to a healthy diet was similarly low with only 37% of 209 participants adhering to a healthy diet (Xu et al., 2010).

However, the low consumption of fruit and vegetables (only 7.0%) in Ghana patients (Mogre et al., 2017) is relatively similar with the study findings where 66.7% of participants did not eat the recommended five serving of fruit and vegetables per day. In Chinese Americans, adherence to a healthy diet was similarly low with only 37% of 209 participants adhering (Xu

et al., 2010). Availability and cost of food, in general, may have contributed to low adherence to a healthy diet in this study.

In a different study the dietary patterns for urban T2DM patients were characterised as (1) a 'purchase' dietary pattern which positively correlated with the consumption of sweets, rice, meat, fruits and vegetables and (2) a 'traditional' dietary pattern that correlated with the intake of fruits, plantain, green leafy vegetables (Frank et al., 2014). Correlation of these patterns with health outcomes needs further investigation. Notwithstanding, the authors propose that dietary patterns are region specific and will differ in different population. The urban population in Zimbabwe predominantly survives on a diet rich in carbohydrates and vegetables but lacking in protein and this diet will probably impact differently on health outcomes of DM.

5.6.3 Smoking

A notable observation in this study is that no participant reported that they were current smokers, despite 14% of the participant having smoked before. A low number (6%) of participants who had ever smoked was observed in T2DM patients in Ghana (Danquah et al., 2012). More encouraging is that amongst newly diagnosed Australian T2DM patients, the tendency to quit smoking was higher compared to non- diabetics (Mogre et al., 2017). It may be that many people relate to the hazardous nature of smoking particularly in disease and so people have a desire to quit. More likely, the lack of smokers in the study may be related to having more female participants in the study. Culturally, it is not acceptable for women to be smokers.

5.7 Association of healthy lifestyle practices with demographics and HbA_{1C}

In this study the number of participants conforming to a comprehensive healthy lifestyle incorporating adequate physical activity, a healthy high fiber diet and not smoking was low

(23.5%). Statistically significant associations were observed for gender, the ability to understand health education and diabetes related complications. No associations were found between a healthy lifestyle and HbA_{1C} levels.

In contrast with this study finding, Sanghani et al., (2013) demonstrated that physical activity was significantly associated with HbA_{1C} levels. They observed that structured exercises were associated with increased reductions in HbA_{1C} levels compared to unstructured exercise. This suggests that beneficial physical activity needs to be purposeful and targeted. In this study, most of the participants that engaged in physical activity did not do so willfully during recreation time rather physical activity was mainly as a result of work related activities. The use of structured and purposeful physical activity is underscored by findings from young T2DM patients who improved their cardiovascular fitness and diet over time and experienced a reduction in HbA_{1C} levels, more so among the male youths (Kriska et al., 2018). Similarly, a comprehensive approach to lifestyle modification led to the control of glycaemic levels in T2DM patients in Korea. While these studies seem to contrast with the findings of this study, it is believed that the lack of a statistically significant association between a healthy lifestyle and HbA_{1C} levels may be due to the very low numbers of participants practicing a comprehensive healthy lifestyle.

In concluding this chapter, T2DM patients were shown to have challenges in adopting a comprehensive lifestyle. The effects of poor healthy lifestyle can be observed in the large number of overweight patients and increased diabetes related complications in the study population. In this study HbA_{1C} was not significantly associated with a healthy lifestyle, probably due to the low number of patients practicing a comprehensive lifestyle. Notable challenges to practicing a healthy lifestyle included lack of money, support and motivation. Hopefully, these areas can be targeted by policy makers to ease the burden of cost of care and provide interventions to enhance social support.

CHAPTER SIX: CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This study has shown that T2DM patients generally do not conform to a comprehensive healthy lifestyle. Patients conformed sub-optimally to individual components of a healthy lifestyle, that is; physical activity, diet and smoking. The study concludes that although T2DM patients seemed to have access to information on diabetes care and understood the information, the knowledge did not translate into practicing a healthy lifestyle. Further studies are warranted to define barriers and challenges to adopting a healthy lifestyle. There is also a need to implement interventions which address the patient-related barriers to healthy lifestyles.

Furthermore, the study revealed that gender, an understanding of diabetes health education and diabetes-related complications are associated with adopting a healthy lifestyle. The results possibly highlight potential areas for initial navigation of interventions such as women led peer groups, different ways of educating patients such as participatory learning and deductive learning, in order to promote healthy lifestyle uptake.

6.2 Recommendations

The findings from this study point towards the following recommendations

- Employment of behavioural change techniques during health education and counselling session to equip T2DM patients with a sense of responsibility for their health and lifestyle
- To provide ongoing contact, support and encouragement to T2DM patients beyond the initial diagnosis and counselling sessions. Diabetes health clubs can be set up to facilitate periodic contact between health personnel and patient. These health clubs can be manned by CHW in liaison with nurses and other health care givers.

- The Diabetes Association of Zimbabwe to take a more active role in advocacy and promotion of healthy lifestyles among T2DM patients. Through memberships, patients can be encouraged to meet together often to share stories and motivate one another
- Despite the lack of recreational grounds, recreational activities can still be performed through the formation of clubs such as a walking club, gardening club and diabetes cooking club. The CHW in liaison with patients may initiate these activities until eventually patients are skilled and equipped to teach one each other.

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APPENDICES

Appendix A: Questionnaire

IDENTIFICATION PANEL	DEMOGRAPHIC
Interviewer name: Name _____	Participant number: ___ ___ ___
Day / Month / Year of interview: ___ ___ /___ ___ / **2 0 1 7**	HOSPITAL_____

VERIFY IF PARTICIPANT IS FROM HARARE, THEN PROCEED BY INTRODUCING YOURSELF AS FOLLOWS:

GOOD ……! MY NAME IS …… AND I AM CONDUCTING A STUDY ABOUT DIABETES IN HARARE. YOU HAVE BEEN SELECTED FOR THIS STUDY. I WOULD LIKE TO SPEAK WITH YOU FOR ABOUT 20 MINUTES. FOLLOWING THE INTERVIEW, WE WILL ASK TO PRICK A HAND TO TAKE BLOOD TO TEST FOR GLYCATED HAEMOGLOBIN. YOU WILL ALSO BE MEASURED FOR HEIGHT AND WEIGHT FOR CALCULATION OF YOUR BODY-MASS INDEX. WE WOULD VERY MUCH APPRECIATE YOUR PARTICIPATION IN THIS SURVEY. ALL THE INFORMATION WE OBTAIN WILL REMAIN STRICTLY CONFIDENTIAL. **YOU ARE REQUIRED TO READ THE INFORMATION SHEET PROVIDED FOR INFORMATION ABOUT THIS STUDY BEFORE WE START.**

MAY I START NOW?

IF CONSENT HAS BEEN OBTAINED, BEGIN THE INTERVIEW.

☐YES, CONSENT HAS BEEN OBTAINED ⇨*GO AHEAD WITH INTERVIEW*

Patient Status:	**Outpatient……..1**	**Inpatient…….2**
Demographics		
1. What was your age at last birthday? *Manga muine makore mangani pamakapedzisira kuita bhavhade renyu?*	……..years Don't Know…….98	
2. Sex *(Observe only)*	Male……..1 Female……..2	

3. What is your marital status? *Makaroora /Makaroorwa here?*	Single……..1 Married……..2 Co-habiting…….3 Divorced……3 Widowed……4	
4. What is the highest level of school you attended? *Makasvika pachidanho chipi pazvidzidzo?*	Never went to school……..1 Primary……2 Secondary……3 Tertiary ……4	
5. **What is your religion?** *Chitendero chenyu ndechipi?*	Christianity……1 Muslim……...…2 Buddhism……3 Hindu……4 None……..……5 Other……6	
6. What is your employment status? *Munoenda kubasa here?*	Formal……..1 Self-employed……2 Unemployed……3 Pensioner……4 Student……..……5 Other (specify) ……6	
7. What is your monthly income? *Munohora marii pamwedzi?*	<$100……1 $100-$300…….2	

	$301-$500…….3 $5001-$1000…….4 >$1000…….…….5 Refused……..6	
Access to information on Diabetes care		
8. How long have you been diagnosed with diabetes? (in years) *Mune nguva yakareba zvakadii kubva pamakaudzwa nachiremba kuti mune chirwere cheshuga (makore)*	……..yrs Don't know……..2	
9. What medication are you taking for diabetes? (Can have more than one response) *Muri kurapa sei chirwere cheshuga (Panogona kuita mhinduro dzakawanda)*	Insulin ……1 Oral hypoglycemic ……2 Diet ……3 Other (specify)……	
10. Have you received any information on diabetes self-care? *Makambonzwa here kana kuverenga nezvechirwere cheshuga*	Yes……1 No……2	If No go to13.
11. If yes to question 10, who gave you the information? *Makaverenga kana kunzwa mashoko aya kupi?*	Nurse …….……....1 Doctor……2 Diabetes Association of Zimbabwe ..3 Media ……4 Family ……...……5 Friends……6 Others (specify)…….....7	
12. How often do you receive this information?		

Munowana mashoko aya kakawanda zvakadii?	(Multiple response)…….	
13. Do you receive health education on diabetes self-care when you come for your monthly routine visits? *Munombowana rudzidziso maererano nezvechirwere cheshuga pamunouya kuchipatara pamwedzi here?*	Yes……1 No……2	If No go to 15
14. Do you understand the health information/ education on diabetes that is offered? *Munonzwisisa here dzidziso dzamunopihwa pamusoro pechirwere?*	Always ……1 Sometimes…….2 Never…….3	
15. Do you have the opportunity to ask questions on information that you do not understand or diabetes related issues affecting you? *Mune mukana here wekubvunza zvamusina kunzwisisa kana zvamunosangana nazvo maererano nechirwere cheshuga?*	Yes……1 No……..2	
16. Are you a member of the Diabetes Association of Zimbabwe? *Muri nhengo ye Diabetes Association yeZimbabwe here.*	Yes……1 No……2	If No go to 17
17. How often do you attend meetings/ activities of the Diabetes Association of Zimbabwe? *Munowanzoenda kumisangano ye Diabetes Association yeZimbabwe kakawanda zvakadii?*	Never……..1 Rarely…….....2 Sometimes……3 Most of the time……..4 Always ……...5	
Adherence to treatment		

18. Do you always take your medication as prescribed? *Munotora mishonga yenyu yamunofanirwa kutora munguva dzakatarwa here?*	Yes……1 No…….……2 Refused……3	If Yes go To 20
19. If No (to 18 above) What are the reasons *Kana iri kwete (pa18 iri pamusoro) zvikonzero ndezvipi*	Stock outs at health facility……...……1 I sometimes forget to take medication...2 Health facility too far…….3 Health facility inaccessible……4 Lack of money to go clinic……5 Lack of money to buy medication…..…6 Do not take deliberately……...…..7 Refuse……8 Other (specify)……...…9	Multiple responses
20. How often in the last one week did you fail to take your medication? *Musvondo rapfuura makatadza kutora mishonga yenyu kakawanda zvakadii?*	Once ……..…..1 Twice……2 Three times…….…..…3 Four or more times……..4 Refused……...5	
Complications		
21. Do you have diabetes related complications? *Mune dambudziko rakanyanya reurwere here nechirwere cheshuga*	Yes…….1 No……..2 Don't know……..3	If No/ Don't know Go to 21
22. What kind of complications do you have? *Dambudziko iri nderei*?	Cardiovascular disease……1	

	Nerve disease……..2 Renal impairment……3 Eye disease……..4 Others (specify) ……	
Physical activity		
a) *Work*		
23. Does your usual work involve vigorous-intensity activity [e.g. carrying or lifting heavy loads, or construction work or digging] for at least 10 mins continuously? *Basa renyu ramunowanzoita rinoita kuti mushande zvakanyanya here (Zvakaita sekutakura zvinorema, kuvaka kana kutimba), kwenguva ingaita maminitsi gumi akateedzana?*	Yes……1 No……2	If No go to 26
24. In a week, on how many days do you do vigorous intensity activities as part of your usual work? *Musvondo, mazuva manganic amunoshanda zvakanyanya mubasa renyu?*		
25. Approximately, how much time (in minutes) do you spend doing vigorous-intensity activities at work in a day? *Munofungidzira kuti nguva yamunotora muchiita mabasa anorema kubasa ingasvika maminetsi manganic pazuva?*	_____min	
26. Does your work involve moderate-intensity activity [e.g. carrying light loads, brisk walking etc] for at least 10 mins continuously?	Yes……1 No……2	If No go to 29

Basa renyu rinosanganisira kushanda kunoti remei zvishoma zvakaita sekufambisa kwemaminutes gumi akateedzana?		
27. In a week, on how many days do you do moderate intensity activities as part of your usual work? *Pavhiki kangani kamunoita mabaaa anoti remeiwo zvishoma kubaaa kwenyu?*	_____days	
28. How much time do you spend doing moderate-intensity activities at work on a day? (in minutes) *Munotora nguva yakareba zvakadii (mumaminutes) pazuva muchiita basa rinoti remei zvishoma?*	_____min	
b) Travel *The following questions do not include the physical activities that you mentioned at work. I will ask you about the usual way you travel for example when going to work or shopping.*		
29. What is your preferred mode for covering the following distances? *Imhando ipi yamunowanzofarira kushandisa mukufamba nzendo dzakareba sezvinotevera?*		
	1=walk 2=cycle 3=car 4=public trans	
<500m	1 2 3 4	
500m-1km	1 2 3 4	
1km-2 km	1 2 3 4	
2-5km	1 2 3 4	
5-10km	1 2 3 4	
>10km	1 2 3 4	
30. How many days in week do you walk or cycle for a minimum of 10 minutes continuously to go to and from places?	_____days	

Mazuva mangani musvondo amunofamba kana kutasva bhasikoro kwemaminutes gumi akateedzana?		
31. Approximately, how much time do you spend walking or cycling for travel on a day? (in minutes) *Pazuva, munofungidzira kuti munofamba kana kutasva bhasikoro kwenguva yakareba sei?*	_____min	
c)Recreational activities *The next questions do not include the work and transport activities that you have already mentioned above. I will ask you about recreational activities, sports and fitness related exercises*		
32. In your area what kind of exercise facilities do you have? *Kwamunogara panel here nzvimbo dzkagadzirirwa kuti vanhu vaite mitambo yekusimbise muviri?*	None……1 Gym…….2 Recreational grounds……..3 Other (specify)……..	
33. Do you use any of the exercise facilities available in your community? *Munoshandisa mitambo idzi here?*	Yes……1 Sometimes…….2 No……3	
34. Which of these do you utilise? *Munoshandisa nzvimbo ipi kuita mitambo inosimbisa muviri?*	Gym…….1 Recreational grounds……2 Other (specify…….	
35. Do you do any vigorous intensity recreational, sports or fitness related exercises [e.g. playing football or running] for at least 10 mins continuously? *Munoitawo here mitambo inesimba rakawanda inosimbisa muviri (sekutamba bhora kana kumhanya)?*	Yes……1 Sometimes…….2 No…….3	If No go to 38
36. In a week, on how many days do you do any of these exercises?		

Musvondo, munoita mitambo iyi kakawanda zvakadii?	_____days	
37. How much time do you spend doing these exercises on a typical day?..... minutes *Munopedza nguva yakawanda zvakadii mumitambo iyi pazuva?*	_____min	
38. Do you do moderate-intensity recreational, sports or fitness related exercises [e.g. very brisk walking, cycling or playing volleyball]? *Munoita mitambo inesimba riri pakati nepakati here inosimbisa muviri (sekufambisa, kuchovha bhasikoro kana kutamba villeyball?*	Yes……1 No……2	
39. In a week, on how many days do you do such exercises? *Musvondo, munoita mitambo iyi kakawanda zvakadii?*	_____days	
40. How much time do you spend doing those exercises on a typical day *Munopedza nguva yakawanda zvakadii mumitambo iyi pazuva?*	_____min	
Diet		
41. Are you eating the foods that you have been advised to eat as a person with diabetes? *Muri kukwanisa here kudya chikafu chamunofanirwa kudya semunhu ane chirwere cheshuga?*	Yes……1 Sometimes…….2 No…….3	If yes go to 43
42. If not, what are the reasons? *Kana musingakwanisi, chikonzero chii?*	Insufficient/ No cash…….…….1 Lack of family support…….……..2 Foods not easily available……..3 It's not important……..….4 Don't like type of foods advised….5	

	Refusal…….6	
43. Which of the following makes up your main meal most of the time? *Ndezvipi zvezvinotevera zvinoumba chikamu chikuru chechikafu chenyu chezuva munguva zhinji?*	carbohydrates ……..1 vegetables…….2 meat/dairy products……..…3 fruits ……4	
44. Which of the following makes up the largest portion of your main meal most of the time? *Ndezvipi zvezvinotevera zvinoumba chikamu chakakurisa chechikafu chenyu chezuvamunguva zhinji?*	carbohydrates ……..1 vegetables…….2 meat/dairy products……..…3 fruits ……4	
45. What is your main source of carbohydrate? *Munowana carbohydrate yenyu yakanyanya kubva muchikafu chipi?*	refined mealie meal based ……...1 unrefined mealie meal based……2 rice……3 potatoes……4 pasta ……5 Other (specify)…….	
46. How many fruits do you eat in a day? Pazuva munodya michero kakawanda zvakadii?	_____times	
47. In between your main meals, what do you eat, that is, snack on? *Pakati nepakati pechikafu chenyu munosanodyei kuti musaite nzara?*	Confectionery……1 Fruit juice …….2 Fruits …….3 Milk/ dairy products…….4 Other (specify)……	

48. How often do you snack between two main meals?	_____times	
49. Which beverage do you take most of the time? *Munowanzonwa chinwiwa chipi munguva zhinji?*	coffee ……1 tea……..2 fizzy drinks……3 other (specify)……..	
50. How often do you take the beverage? *Munowanzonwa chinwiwa ichi zvakawanda zvakadii?*	_____times	
51. If you take coffee or tea, how many teaspoons of sugar do you put in a standard tea/coffee mug? *Kana muchinwa tii kana kofi munoisa shuga yakawanda zvakadii mukapu iri pakati nepakati?*	_____teaspoons	
Smoking and alcohol intake		
52. Have you ever smoked? *Makambosvuta fodya here?*	Yes……1 No……..…2	If No go to 55
53. Do you currently smoke? *Parizvino munoputa fodya here?*	Yes……1 No……..…2	
54. If you smoke, how many cigarettes do you smoke per day on average? *Kana muchiputa, pazuva munoputa kangani?*	_____times Refused……..1 Don't know……2	
55. Do you currently drink alcohol such as beer, wine, and spirits? *Parizvino munombonwa zvinodhaka sedoro kana waini here?*	Yes……1 No……,…2	If No go to 58
56. How much alcohol (cups) do you consume per day on average?		

Pazuva munonwa zvakanyanya zvakadii?	_____cups	
57. How do you rate your alcohol intake? *Munofunga munonwa zvinodhaka zvakanyanya sei?*	Light……..1 Moderate……2 Heavy ……3 Refused……..5	

58. Do you have challenges in practising a healthy lifestyle (high fiber, low calorie diet, exercising and not smoking) *Mune zvipingaidzo here zvamunosangana nazvo mukurarama hupenyu hune utano (zvakaita sechikafu chine faibha, shuga shoma mitambo yekusimbisa muviri kana kurega kuputa)?*	Yes……1 No……,…2	
59. If yes, what are the challenges that you face? *Kana iri hongu, ndeapi matambudziko amunosangana nawo.*	Lack of support……..1 Lack of self-motivation…….2 Lack of adequate money……3 Lack of time……..….4 Inability due to diabetes related complications……..5 Inability due to non-diabetes related complications……..…6 Lack of recreational facilities……7 Health Facility too far…….8 Other (specify)…….	
60. If no, what enables you to do so? *Kana mati kwete ndezvipi zvinokuitai murambe muchi gona kurarama hupenyu hune utano*	An adequate support system……..1 Self-motivation …….2 Adequate money……...3 Adequate time……4 Available recreational facilities….5 Health Facility Accessible…….6 Other (specify)…….	

61. What do you think should be done to help diabetes patients live a healthy lifestyle? *Ndezvipi zvamungafunga kuti zvingaitwa kubataira* varwere veshuga kuti vararame hupenyu hune utano		

Results of study components	Yes	No	Measurement value
blood sample taken	1	2	HBA_{IC} .....
Mass Taken	1	2	_____kg
Height Taken	1	2	_____m

Appendix B: Consent form

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa
Tel: +27 21-959, Fax: 27 21-959
E-mail:

CONSENT FORM

Title of Research Project: Assessment of Healthy Lifestyle Practices in Type 2 Diabetes Patients and Association with Glycated Haemoglobin Levels in Harare, Zimbabwe

The study has been described to me in language that I understand and I freely and voluntarily agree to participate. My questions about the study have been answered. I understand that my identity will not be disclosed and that I may withdraw from the study without giving a reason at any time and this will not negatively affect me in any way. I agree to have my blood specimen tested for glycated haemoglobin.

Participant's name……..
Participant's signature……
Witness……
Date……

Should you have any questions regarding this study or wish to report any problems you have experienced related to the study, please contact:

Study PI: Joseph Chipinduro
NIHR, Box CY 573, Causeway Harare
Cell: 0772 422 192
Email: jchipinduro@nihr.co.zw

Study Supervisor: Ms Lungiswa Tsolekile
University of the Western Cape
Private Bag X17, Belville 7535
Email: ltsolekile@uwc.ac.za
Tel: +27 21959 9379

OR

UWC Biomedical Research Ethics Committee:

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

Research Office, New Arts Building, C-Block, Top Floor, Room 28

Appendix C: Participant Informed consent

UNIVERSITY OF THE WESTERN CAPE

Private Bag X 17, Bellville 7535, South Africa
Tel: +27 21-959 2809 Fax: 27 21-959 2872
E-mail: soph-comm@uwc.ac.za

MRCZ FORM 109

MRCZ No. _____

PARTICIPANT INFORMED CONSENT

Project Title: Assessment of Healthy Lifestyle Practices in Type 2 Diabetes Patients and Association with Glycated Haemoglobin Levels in Harare, Zimbabwe.

Name of Principal Investigator:
Joseph Chipinduro
Cell: 0772 422 192

What you should know about this research study:

- We give you this consent so that you may read about the purpose, risks, and benefits of this research study.
- Routine care is based upon the best known treatment and is provided with the main goal of helping the individual patient. The main goal of research studies is to gain knowledge that may help future patients.
- We cannot promise that this research will benefit you. Just like regular care, this research can have side effects that can be serious or minor.
- You have the right to refuse to take part, or agree to take part now and change your mind later.
- Whatever you decide, it will not affect your regular care.
- Please review this consent form carefully. Ask any questions before you make a decision.
- Your participation is voluntary.

PURPOSE OF STUDY

You are being asked to participate in a research study of Assessing Healthy Lifestyle Practices in Type 2 Diabetes Patients and Association with Glycated Haemoglobin in Harare. The purpose of this research project is to collect information on health lifestyle practices by persons with type 2 diabetes and see if the practices adopted have a positive effect on the reduction of glycated haemoglobin levels in their bodies. I would like to find out how diabetes patients have changed their lifestyle in order to reduce complications

due to the disease. The information gathered will help in understanding preferred practices and finding ways to structure interventions that enable type 2 diabetic patients adopt healthy living. The findings of the study will help in understanding the practices most preferred by Zimbabwean diabetic patients and also assist in the development of policies that will improve future diabetes programs. The programs shall be tailor made to meet the needs of the Zimbabwean diabetes patients. You were selected as a possible participant in this study because you have type 2 diabetes. The study seeks to recruit 142 participant from Parirenyatwa and Harare Hospitals.

PROCEDURES INVOLVED IN THE STUDY AND DURATION

Interviewer administered questionnaire: You will be asked to participate in an interviewer administered questionnaire. The questions seek to understand: your life background; access to health education; current practices you are doing as treatment to diabetes; your knowledge on diabetes and lifestyle behaviour.

***Measurement of BMI*:** You will be measured for mass and height for calculation of body mass index (BMI).

Testing of glycated haemoglobin: You will be tested for glycated haemoglobin level in your blood (if you have not been tested in the last 3 months). Your blood sample collected for routine treatment process will be analysed for this test. A blood sample of about 2ml will be taken from your arm and taken to the laboratory for testing of glycated haemoglobin. If you do not have a routine sample for treatment you shall be asked for permission to collect and test your blood. You will have to consent before any tests and blood collection is done. You will then be pricked on the hand to collect about 2ml of blood.

The questionnaires will take approximately 20 minutes of your time. Measurement of height, weight and blood collection is expected to take 10 minutes. Therefore we expect to be with you for about 30 minutes overall.

WHAT ARE THE RISKS AND DISCOMFORTS OF THIS RESEARCH?

There may be some risks from participating in this research study. For example you may feel pain from pricking during blood collection. You may also feel uncomfortable, such as being embarrassed to give some of your personal or sensitive information. We will nevertheless minimise such risks and act

promptly to assist you if you experience any discomfort, psychological or otherwise during the process of your participation in this study. Where necessary, an appropriate referral will be made to a suitable professional for further assistance or intervention.

WHAT ARE THE BENEFITS OF THIS RESEARCH?

The benefits to you include being tested for blood sugar (glycated haemoglobin) and BMI for free. However, the major benefit of this research is not designed to help you personally, but the results may help the investigator learn more about how diabetes patients are conforming to lifestyle changes in management of the disease. We hope that, in the future, other people might benefit from this study through improved understanding of the needs of type 2 diabetes patients in changing their lifestyle in order to manage the condition. It is hoped that from the information obtained from this study diabetes programs will be tailor made to the needs of the Zimbabwean patients.

WOULD MY PARTICIPATION IN THIS STUDY BE KEPT CONFIDENTIAL?

If you indicate your willingness to participate in this study by signing this document, we plan to disclose the information collected to the researcher's supervisors. Information may also be availed to the Medical Research Council of Zimbabwe should they require it or for monitoring purposes.

To ensure your anonymity, the survey is anonymous and will not contain information that may personally identify you. We will use identification codes only on data forms and blood specimens. The researcher will have access only to the identification codes which will be used to link a survey and the results for glycated haemoglobin from the laboratory. To ensure your confidentiality all data forms will be kept in lockable filling cabinets and storage areas. All forms on computer will be protected through use of password-protected computer files.

IRB No. _____

VOLUNTARY PARTICIPATION AND STUDY WITHDRAWAL

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time and your decision will not affect your future relations with Parirenyatwa Hospital/ Harare Hospital, its personnel and associated hospitals.

IRB No. _____

SIGNATURE PAGE

PROJECT TITLE:
ASSESSMENT OF HEALTHY LIFESTYLE PRACTICES IN TYPE 2 DIABETES PATIENTS AND ASSOCIATION WITH GLYCATED HAEMOGLOBIN LEVELS IN HARARE, ZIMBABWE.

Protocol Version Number 001/August 2017

OFFER TO ANSWER QUESTIONS

Before you sign this form, please ask any questions on any aspect of this study that is unclear to you. You may take as much time as necessary to think it over.

AUTHORIZATION

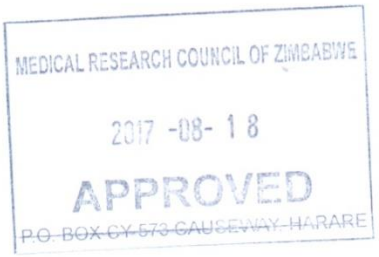
You are making a decision whether or not to participate in this study. Your signature indicates that you have read and understood the information provided above, have had all your questions answered, and have decided to participate.

_____		_____
Name of Research Participant (please print)		Date
_____	_____	_____
Name of Staff Obtaining Consent	Signature	Date
_____	_____	_____
Name of Witness (*if required*)	Signature	Date

IRB No. _____

YOU WILL BE OFFERED A COPY OF THIS CONSENT FORM TO KEEP.

If you have any questions concerning this study or consent form beyond those answered by the investigator, including questions about the research, your rights as a research participant or research-related injuries; or if you feel that you have been treated unfairly and would like to talk to someone other than a member of the research team, please feel free to contact the Medical Research Council of Zimbabwe (MRCZ) on telephone (04)791792 or (04) 791193 and cell phone lines 0784 956 128. The MRCZ Offices are located at the National Institute of Health Research premises at Corner Josiah Tongogara and Mazowe Avenue in Harare.



Appendix D: University of Western Cape Approval of Study

UNIVERSITY of the WESTERN CAPE

OFFICE OF THE DIRECTOR: RESEARCH
RESEARCH AND INNOVATION DIVISION

Private Bag X17, Bellville 7535
South Africa
T: +27 21 959 2988/2948
F: +27 21 959 3170
E: research-ethics@uwc.ac.za
www.uwc.ac.za

25 January 2017

Mr J Chipinduro
School of Public Health
Faculty of Community and Health Sciences

Ethics Reference Number: BM17/1/5

Project Title: Assessment of Health Lifestyle Practices in Type 2 Diabetes Patients and Association with Glycated Haemoglobin Levels Harare, Zimbabwe.

Approval Period: 27 January 2017 – 27 January 2018

I hereby certify that the Biomedical Science Research Ethics Committee of the University of the Western Cape approved the scientific methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval. Please remember to submit a progress report in good time for annual renewal.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

PROVISIONAL REC NUMBER -130416-050

Appendix E: Medical Research of Zimbabwe Approval Letter

Telephone: 791792/791193
Telefax: (263) - 4 - 790715
E-mail: mrcz@mrcz.org.zw
Website: http://www.mrcz.org.zw

Medical Research Council of Zimbabwe
Josiah Tongogara / Mazoe Street
P. O. Box CY 573
Causeway
Harare

APPROVAL LETTER

REF: MRCZ/B/1347 **18 August, 2017**

Mr.Joseph Chipinduro
National Institute of Health Research (NIHR)
Box CY 573, Causeway
Harare

RE: Assessment of Healthy Lifestyle Practices in Type 2 Diabetes Patients and Association with Glycated Haemoglobin Levels in Harare, Zimbabwe

Thank you for the above titled proposal that you submitted to the Medical Research Council of Zimbabwe (MRCZ) for review. Please be advised that the Medical Research Council of Zimbabwe has **reviewed** and **approved** your application to conduct the above titled study. This is based on the following documents that were submitted to the MRCZ for review:

a) Study proposal
b) Informed Consent Forms
c) Study data collection tools

APPROVAL NUMBER : MRCZ/B/1347
This number should be used on all correspondence, consent forms and documents as appropriate.

- **APPROVAL DATE : 18 August, 2017**
- **TYPE OF MEETING : Expedited**
- **EXPIRATION DATE : 17 August, 2018**
  After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the MRCZ Offices should be submitted one month before the expiration date for continuing review.
- **SERIOUS ADVERSE EVENT REPORTING:** All serious problems having to do with subject safety must be reported to the Institutional Ethical Review Committee (IERC) as well as the MRCZ within 3 working days using standard forms obtainable from the MRCZ Offices.
- **MODIFICATIONS:** Prior MRCZ and IERC approval using standard forms obtainable from the MRCZ Offices is required before implementing any changes in the Protocol (including changes in the consent documents).
- **TERMINATION OF STUDY:** On termination of a study, a report has to be submitted to the MRCZ using standard forms obtainable from the MRCZ Offices.
- **QUESTIONS**: Please contact the MRCZ on Telephone No. (04) 791792, 791193 or by e-mail on mrcz@mrcz.org.zw.

Other

- Please be reminded to send in copies of your research results for our records as well as for Health Research Database.
- You're also encouraged to submit electronic copies of your publications in peer-reviewed journals that may emanate from this study.

Yours Faithfully

.....

MRCZ SECRETARIAT
FOR CHAIRPERSON
MEDICAL RESEARCH COUNCIL OF ZIMBABWE

MEDICAL RESEARCH COUNCIL OF ZIMBABWE
2017 -08- 18
APPROVED
P.O. BOX CY 573 CAUSEWAY HARARE

PROMOTING THE ETHICAL CONDUCT OF HEALTH RESEARCH

Appendix F: Harare Central Hospital Ethics Committee Approval

Telephone: 621100-19
Fax: 621157

ZIMBABWE

Reference: HCHEC 050417/21

HARARE CENTRAL HOSPITAL
P. O. Box ST 14
SOUTHERTON
Harare

05 May 2017

Mr. Joseph Chipinduro
National Institute of Health Research
P.O. Box CY 573,
Causeway
Harare

Dear Mr. Chipinduro,

REF: ASSESSMENT OF HEALTH LIFESTYLE PRACTICES IN TYPE 2 DIABETES PATIENTS AND ASSOCIATION WITH GLYCATED HAEMOGLOBIN LEVELS, HARARE, ZIMBABWE

I am glad to advise you that your application to conduct a study Entitled: Assessment of Health Lifestyle Practices in Type 2 Diabetes Patients and Association with Glycated Haemoglobin Levels, Harare, Zimbabwe (Ref: HCHEC 050417/21), has been approved by the Harare Hospital Ethics Committee.

This approval is premised on the submitted protocol. Should you decide to vary your protocol in any material way please submit these for further approval.

You are advised to avail the results of your study whether positive or negative to the hospital through the committee for our information.

Yours sincerely,

HARARE CENTRAL HOSPITAL
DEPARTMENT OF MEDICINE
05 MAY 2017
P.O. BOX ST14 SOUTHERTON
HARARE, ZIMBABWE

DR. C. Pasi
Chairman Harare Central Hospital Ethics Committee

MEDICAL RESEARCH COUNCIL OF ZIMBABWE
2017 -08- 18
RECEIVED

Appendix G: Parirenyatwa Group of Hospitals Application and Consent Form

FORWARD TO MRCZ
20/04/17

PLEASE COMPLETE THIS FORM TOGETHER WITH YOUR APPLICATION

APPLICATION FOR RESEARCH AT PARIRENYATWA HOSPITAL

NAME OF APPLICANT JOSEPH CHIPINDURO

ADDRESS OF APPLICANT NATIONAL INSTITUTE OF HEALTH RESEARCH, CNR MAZOE ST/ J. TONGOGARA AVE, HARARE

PARIRENYATWA GROUP OF HOSPITALS
CLINICAL DIRECTOR
20 APR 2017
P.O. BOX CY1600 CAUSEWAY HARARE

NAME OF INSTITUTION

UNIVERSITY OF WESTERN CAPE, SOUTH AFRICA

NAME OF SUPERVISOR

MS. LUNGISWA TSOLEKILE

PROJECT PROPOSAL

ASSESSMENT OF HEALTHY LIFESTYLE PRACTICES IN TYPE 2 DIABETES PATIENTS AND ASSOCIATION WITH GLYCATED HAEMOGLOBIN LEVELS, HARARE, ZIMBABWE

OBJECTIVES

① TO DETERMINE PROPORTION OF TYPE 2 DIABETIC PATIENTS CONFORMING TO HEALTHY LIFESTYLE PRACTICES IN HARARE ② TO DETERMINE THE LEVELS OF GLYCATED HAEMOGLOBIN IN TYPE 2 DIABETIC PATIENTS ③ TO DETERMINE THE ASSOCIATION BETWEEN GLYCATED HAEMOGLOBIN LEVELS AND THE HEALTHY LIFESTYLE PRACTICES IN TYPE 2 DIABETIC PATIENTS

METHODOLOGY

A CROSS SECTIONAL STUDY WITH PATIENTS ENROLLED AS THEY PRESENT TO DIABETIC CLINIC. A SAMPLE OF 142 PARTICIPANTS TO BE RECRUITED AT PARIRENYATWA AND HARARE HOSPITALS. STRUCTURED QUESTIONNAIRE WILL BE CONDUCTED AND PATIENTS MEASURED FOR BMI. RETROSPECTIVE REVIEW OF RECORDS FOR GLYCATED HAEMOGLOBIN AND ALSO BLOOD COLLECTION FOR GLYCATED HAEMOGLOBIN

TIMETABLE

PATIENT INCLUSION CIRETRIA

① MALES AND FEMALES, WHO ARE TYPE 2 DIABETIC PATIENTS
② PATIENTS AGED 18 YEARS AND ABOVE
③ RESIDENT IN HARARE

MEDICAL RESEARCH COUNCIL OF ZIMBABWE
2017 -08- 18
RECEIVED
P.O. BOX CY 573 CAUSEWAY HARARE

USE OF RESULTS

1. POLICY CHANGE AS RECOMMENDATIONS WILL BE MADE FOR DESIGNING TAILOR-MADE INTERVENTIONS FOR ZIMBABWE
2. RESULTS WILL BE PUBLISHED IN PEER REVIEWED JOURNALS
3. RESULTS WILL BE DISSEMINATED THROUGH WORKSHOPS OR CONFERENCE

REFERENCES

Prof. K. Dunn

Prof. N. Midzi

I promise to forward the Conclusions of the study to the CLINICAL DIRECTOR

NAME: JOSEPH CHIPINDURO SIGNATURE: [signature]

STATION PERMISSION

1. CONSULTANT

NAME: Dr T. MANYANGA

Agree/Do not Agree

2. WARD MANAGER

NAME: GD Ward 5 NO II