

**FACTORS ASSOCIATED WITH PARTICIPATION IN PHYSICAL
ACTIVITY AMONG ADULTS WITH DIABETE MELLITUS IN
KIGALI, RWANDA**



UNIVERSITY *of the*
WESTERN CAPE

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ACTIVITY AMONG ADULTS WITH DIABETE MELLITUS IN
KIGALI, RWANDA**

BY

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**A minithesis submitted in partial fulfilment of the requirements for the
degree of Masters of Science (Physiotherapy) in the Department of
Physiotherapy, University of the Western Cape.**

November 2008

Supervisor:

Prof. Julie Phillips

DECLARATION

I hereby declare that “*Factors associated with participation in physical activity among adults with diabetes mellitus in Kigali, Rwanda*” is my own work, that it has not been submitted, or part of it, 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 means of complete references.

Aline M. Kabanda



Signature.....

November 2008

Witness:

.....

Prof. Julie Phillips

DEDICATION

To my husband Emmanuel Rudaseswa, and my sons Romeo and Enzo, words can not express how blessed I feel to have you in my life and how much I love you

To my parents, Joseph Kabanda and Gatete Daphrose, whom I am eternally grateful for their unconditional love, support beyond measure, and faith in me.

To my parents in law, Dr Wenceslas Rudaseswa and Marie Mukayisenga, for their love, support and warm encouragements throughout these two years far from home.

To my brothers Eric, Olivier and Diane Kabanda and Jean Baptiste Ganza for the love

that we always share

I love you all!!!

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ABSTRACT

Diabetes mellitus is now one of the most common non-communicable diseases, and is the fifth leading cause of death in most developed countries. Regular physical activity is strongly recommended for individuals with diabetes for its beneficial effects in the improvement of blood glucose control and insulin sensitivity, prevention and reduction of morbidities and complications, as well as for its cardiovascular benefits. However, despite its known benefits, this modality of treatment and prevention of diabetes mellitus continues to be underused. The present study aimed to examine the demographic, social and health-related factors that are associated with levels of physical activity participation among adults with diabetes mellitus in Kigali, Rwanda. A cross-sectional design using a quantitative method was used. The participants' levels of participation in physical activity and their association with socio-demographic and health-related factors were measured by use of a structured self-administered questionnaire adapted from three valid and reliable questionnaires. One hundred fifty six (156) participants were selected using a simple random sampling technique. Descriptive and inferential statistics by use of the Statistical Package for Social Sciences (SPSS) version 16.0 were used to analyze the data. Chi square and the student t-test were used to determine the association between different variables. Alpha level was set at 0.05. The mean age of the sample was 48 years (SD=14.7). Females constituted 53.2% while males were only 46.8% of the sample. Most of the participants (58.5%) were married and had a primary school level education (41%). The body mass index was significantly associated with the gender, with the majority of males (52.1%) having a normal weight and the majority of females who were either overweight or obese (67.5%). More than a third (39.7%) of the participants was

categorized as inactive while 60.3% were classified as physically active. Participants categorized as active had a significantly lower mean age (45.67 years) than those categorized as inactive (51.69 years). A non-significant association between the gender and the patterns of physical activity was observed. With regards to the different categories of physical activity, the lowest mean MET-minutes/week was obtained during leisure-time activities (233.37 MET-minutes/weeks) while highest mean MET-minutes/week during work-related activities (685.78 MET-minutes/week. The following factors were found to be significantly associated with the levels of physical activity: age, marital status, level of education, and self-efficacy for diabetes. The majorities of participants (79.5%) reported that they have encountered barriers to physical activity participation and were mostly inactive. Most common barriers indicated by the participants were: having a poor health status (35.9%), the lack of motivation (28.8%) and the lack of awareness of the importance of PA (25%). The findings of the present study highlight the need for the implementation of health promotion strategies aimed at promoting physical activity lifestyle among individuals with diabetes mellitus in Rwanda. Efforts should be made in the education of people with diabetes on the benefits of integrating regular physical activity in their daily routine and specific guidance should be given to them on the precautions to be taken, as well as the type, and intensity of physical activity.

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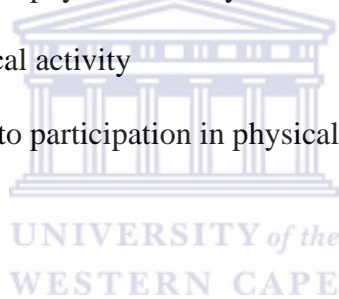
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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

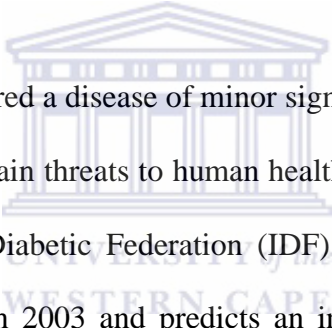
This chapter highlights the importance of physical activity in addressing the increasing and alarming burden of chronic diseases of lifestyle, with emphasis on diabetes mellitus. The chapter also reflects on the levels of physical activity that are recommended for the prevention as well as the management of diabetes mellitus. The aim, objectives and statement of the problem are highlighted. Finally, the significance of the study, definition of key terms and abbreviations used in this study are also given.

1.2 BACKGROUND OF THE STUDY

Non-communicable diseases or chronic diseases of lifestyle such as diabetes mellitus, cardiovascular disease, stroke, cancer and chronic respiratory diseases are currently the leading cause of mortality in the world, representing 60% of all deaths (World Health Organization, 2008a). These chronic conditions have now become the main public health challenge for the 21st century, as a result of their impact on personal and national health and their association with premature morbidity and mortality (Zimmet, Alberti & Shaw, 2001). These leading diseases share key risk factors, mainly the lack of physical activity, unhealthy diet, tobacco and alcohol use (Yach, Hawkes, Gould & Hofman, 2004).

Physical inactivity, now increasingly recognized as an important determinant of health, is the result of a progressive shift of lifestyle towards a more sedentary pattern, in

developing countries as much as in industrialized ones (Roberts & Barnard, 2005). Kengne, Amoah and Mbanya (2005) highlighted that the adoption of Western lifestyles has been established as a consistent theme for the rise in diabetes and non-communicable diseases in Sub-Saharan Africa. They added that the common elements of “westernization” include a diet higher in total calories and fat but lower in fiber, and a lesser need to spend energy because of labour-saving devices. Furthermore, they explained that in Sub-Saharan Africa, the increasing non-communicable disease burden is compounded by the lack of a coherent policy on chronic disease prevention, control, surveillance and research.



Diabetes mellitus, long considered a disease of minor significance to world health, is now taking its place as one of the main threats to human health in the 21st century (Zimmet et al., 2001). The International Diabetic Federation (IDF) estimates that there were 189 million people with diabetes in 2003 and predicts an increase to 324 million in 2025 (IDF, 2005a). Similarly, the World Health Organization in 2006 reported that by the year 2025, there will be an almost 170% increase in the number of diabetics in developing countries, while the increase in developed countries will be about 42% (WHO, 2006a).. Furthermore the IDF and WHO (2006) reported in a Joint initiative of IDF Africa and WHO-AFRO that the expected majority of the increase in numbers of people with diabetes will be predominantly in the 45-64 year age group particularly in developing countries. They further explained that this is of particular economic importance, as people will be affected in the most productive period of their lives. Worldwide excess mortality attributable to diabetes is estimated at 2.9 million deaths, which is equivalent to 5.2% of

world all-cause mortality in the year 2000 (Roglic et al., 2005). Diabetes also contributes to higher rates of morbidity as people with diabetes are at higher risk for heart disease, blindness, kidney failure, extremity amputations, and other chronic conditions (American Diabetes Association, 2003a). Thus prevention of diabetes and its micro- and macro-vascular complications should be an essential component of future public health strategies for all nations (Zimmet et al., 2001).

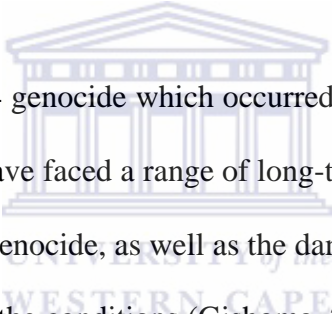
In order to reduce the impact of diabetes worldwide, the World Health Organization and the International Diabetes Federation (IDF) in 2006 have launched the Diabetes Action Now program. The program focuses on low and middle – income communities, particularly in developing countries and its purpose is to stimulate and support the adoption of effective measures for the surveillance, prevention and control of diabetes (Unwin & Marlin, 2006). In addition, as the authors further explained, the key aim of the program is to achieve a substantial increase in the global awareness about diabetes and its complications. Effective education may thus produce changes in knowledge and understanding and may even result in a change in behaviour or lifestyle (Krentz, 2000).

According to Durstine and Moore (2003) physical activity is considered by many to be one of the cornerstones of diabetes care. They added that physical activity has the potential to provide several benefits for the diabetic individual which may include: the possible improvement in blood glucose control, improvement of insulin sensitivity thus lowering medication requirement, reduction in body fat, cardiovascular benefits and stress reduction. Similarly, Deshpande, Baker, Lovegreen & Brownson (2005) stated that

regular physical activity is often recommended for individuals with diabetes for its beneficial effects on the metabolic risk factors often associated with diabetes complications. All levels of physical activity, including leisure activities, recreational sports, and competitive professional performance can be performed by people with diabetes who do not have complications and have good glucose control (American Diabetes Association, 2003b). However, despite these and other benefits, many patients with diabetes do not include regular physical activity as a part of their diabetes care (Chau & Edelman, 2001). Despite the fact that the importance of exercise and physical activity is probably being stressed more to the diabetic patient compared with non-diabetic individuals, diabetic patients are no more likely to exercise than nondiabetic individuals (Eriksson, 1999). Patients with chronic illness often avoid exercise for fear of making their condition worse or overexerting themselves, yet these patients are the ones that stand to benefit most from a regular exercise program (Kolt & Snyder-Mackler, 2003).

In addition to the role of physical activity in the management of diabetes, it has also been suggested in a variety of observational and experimental epidemiologic studies that physical activity may play a significant role in the prevention of type 2 diabetes mellitus (Tuomilehto et al., 2001, Kriska et al., 2003; Laaksonen et al., 2005; LaMonte, Blair & Church, 2005). Beyond the effect of activity on body mass and composition, physical activity may reduce the risk for type 2 diabetes through improvements in insulin sensitivity (Ivy, Zderic & Fogt, 1999). The evidence linking physical inactivity to the future risk of type 2 diabetes is strong (Bradshaw & Steyn, 2001; Tuomilehto et al., 2001),

and modification of behaviour is a critical and effective element of strategies aimed at the prevention of this increasingly prevalent disorder. In addition, several studies have demonstrated that lifestyle modifications in the form of diet and regular moderate physical activity sharply decrease the likelihood of developing type 2 diabetes in high-risk individuals who have impaired glucose tolerance or impaired fasting glucose (Pan et al., 2001; Lindström et al., 2004; Fowler, 2007). To the same opinion, Morrato, Hill, Wyatt, Ghushchyan and Sullivan (2003) reported in their study measuring the levels of physical activity in the US population, that physical activity is least likely to be participated by those who already have diabetes and those at risk of developing diabetes.



During the years since the 1994 genocide which occurred in Rwanda, many thousands of people with diabetes mellitus have faced a range of long-term difficulties, including those provoked by the effects of the genocide, as well as the danger of disability or death due to the numerous complications of the conditions (Gishoma, 2005). The author further added that the excessive cost of insulin and diabetes supplies to people with the condition remains a major threat to the health of most people with diabetes in Rwanda. Tumusiime and Frantz (2006) reflected on one of the consequence of the civil war as well as the genocide, being the massive migration of people from rural to urban areas to seek for job opportunities. The urban environment is known to be associated with increased opportunities for sedentary employment, which accelerates the development of adult “high risk” lifestyle (Torun et al, 2002). This may be particularly true for Rwanda, as highlighted in a study done by Kagwiza, Phillips and Struthers (2005) to measure the levels of physical activity among women working in several institutions in Kigali, the

capital city. The results of this study revealed that the majority of working women were sedentary, thus increasing their risk of developing chronic diseases of lifestyle such as diabetes mellitus and hypertension.

In consideration of the alarming and increasing prevalence of diabetes mellitus in developing countries such as Rwanda, the researcher felt the need to assess the levels of physical activity among adults with diabetes mellitus and to identify the factors associated with it and the possible barriers to physical activity. This information may be a useful tool in the implementation of promotion strategies aiming at the prevention and appropriate management of people with diabetes and those at risk of developing diabetes.

1.3 PROBLEM STATEMENT

Physical activity may be of great therapeutic value for the individuals with diabetes. Exercise training and physical activity result in a variety of physiological, metabolic and hormonal responses beneficial to the diabetic patient (Eriksson, 1999). Furthermore, physical activity may prevent or delay the onset of complications related to diabetes such as cardiovascular diseases, blindness, kidney damage and amputations. Therefore, there is a need to know to what extent physical activity is performed among adults with diabetes mellitus and understand the factors related to it.

1.4 AIM OF THE STUDY

The aim of the study is to examine the factors that are associated with the levels of physical activity among adults with diabetes mellitus in Kigali, Rwanda.

1.5 SPECIFIC OBJECTIVES

The objectives of the study are:

1. To establish the levels of physical activity among adults with diabetes mellitus in Kigali, Rwanda.
2. To examine the factors associated with physical activity levels among adults with diabetes mellitus in Kigali, Rwanda.
3. To identify the barriers to physical activity participation among adults with diabetes mellitus in Kigali, Rwanda.

1.6 SIGNIFICANCE OF THE STUDY

Physical activity plays a key role in the management of diabetes mellitus. Physiotherapists are ideally suited to take a greater role in all aspects of diabetes management, from prevention to rehabilitation following complications. Moreover, physiotherapists have an essential role in the diabetes management through the implementation of appropriate physical activities and exercise programs. Unfortunately, diabetic patients are only referred to physiotherapy for the management of different complications related to diabetes mellitus. There is a need to determine the levels of physical activity participation among adults with diabetes mellitus and understand their association with demographic, social and health-related factors, as the benefits of engagement in physical activity by the diabetic individual has been proven by research. Furthermore the results of the study and the recommendations which will arise from them will definitely help in the improvement of the diabetes mellitus management in which the medical team will work hand in hand for a better management of diabetes mellitus

through safe monitoring and the promotion of a healthy lifestyle by the adaptation of suitable exercise program to diabetic patients.

1.7. DEFINITION OF KEY TERMS

Physical Activity: is defined as any bodily movement produced by skeletal muscles that require energy expenditure (WHO, 2008b).

Exercise: is defined as a physical activity that is planned, structured, repetitive, with the objective of improving the general physical fitness though the increased in strength, endurance and flexibility (Durstine and Moore, 2003)

Diabetes mellitus: This is a chronic disease characterized by high levels of blood glucose resulting from defects in insulin production, insulin action, or both (Center for Disease Control and Prevention, 2005).

Cardiovascular diseases: These are diseases which are caused by disorders of the heart and blood vessels, and include coronary heart (heart attacks), cerebrovascular disease (stroke), raised blood pressure (hypertension), peripheral artery disease, rheumatic heart disease, congenital heart disease and heart failure. The major causes of cardiovascular diseases are tobacco use, physical inactivity, and unhealthy diet (WHO, 2008c)

Obesity and overweight: They are defined as abnormal or excessive fat accumulation that presents a risk to health. A measure of obesity is the body mass index (weight in kilograms divided by the square of his height in meters). A person with a BMI of 30 or more is generally considered obese, while BMI equal to or more than 25 classify the person as overweight (WHO, 2006b)

Sedentary: The original meaning of the word “sedentary” is related to the higher propensity to be sitting down without performing any physical activity that requires

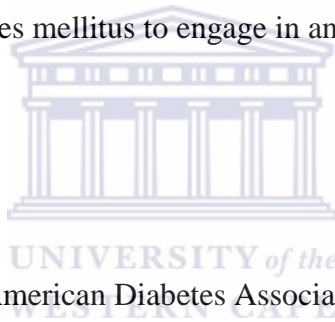
energy expenditure (Varo, Gonzalez, Estevez, Kearney, Gibney and Martinez, 2003).

Non-communicable diseases: These are diseases which are classified as non-infectious, as they can not be transmitted onto others, and include diseases such as cancer, diabetes mellitus, hypertension, and cardiovascular diseases (Tsolekile, 2007).

MET- minutes/ week: The Metabolic equivalent (MET) - minutes per week is a unit used to measure the energy expenditure during a physical activity. It is calculated as the MET intensity multiplied by the minutes for each activity over a seven day period (Craig et al., 2003).

Barriers to physical activity participation: In the context of this study, barriers refer to what prevent adults with diabetes mellitus to engage in any physical activity.

1.8 ABBREVIATIONS



ADA	American Diabetes Association
BMI	Body Mass Index
CDC	Center for Disease Control and Prevention
DM	Diabetes Mellitus
DSME	Diabetes Self-Management Education
FAO	Food and Agriculture Organization of the United Nations
IDF	International Diabetic Federation
IFG	Impaired fasting glucose
IGT	Impaired glucose tolerance
IPAQ	International Physical Activity Questionnaire

MET-minutes/week	Metabolic Equivalent- minutes per week
NCDs	Non-communicable diseases
PA	Physical Activity
RDA	Rwanda Diabetic Association
UWC	University of the Western Cape
WHO	World Health Organization
WHO-AFRO	World Health Organization Office for Africa
X2-test	Chi-square test

1.9 OUTLINE OF CHAPTERS

Chapter one describes the background of the study, in which a general picture of non-communicable diseases in general and diabetes mellitus in particular is described. The benefits of physical activity both in the prevention and the management of diabetes, as well as the recommended levels for adults with diabetes are highlighted. The statement of the problem, the aim, objectives and significance of the study are given. The chapter ends with the definition of key terms used in the study and the outline of chapters.

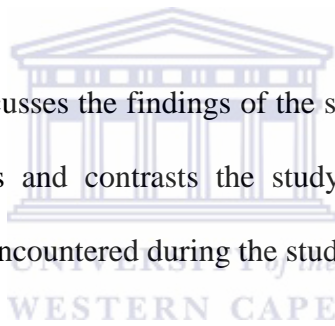
Chapter two presents a literature review pertaining to the global burden of non-communicable diseases, particularly diabetes mellitus. This is followed by a description of the different common types of diabetes. The management approach of diabetes is described, and the role of physical activity both in the prevention and management of diabetes is emphasized. A description of various physical activity health promotion programs and strategies concludes the chapter.

Chapter three describes the methodology used for this study. The research setting, study design, study population and sample are described. Moreover, the validity and reliability of the instrument used is explained. The chapter also describes the procedures used to collect data, as well as the methods used in their analysis. Finally, the issues of ethical considerations are highlighted.

Chapter four presents the results of the study. In this chapter, both descriptive and inferential statistic results of the study are well describes and presented by use of table, figures and pie charts.

Chapter five interprets and discusses the findings of the study and the implications of the results. The chapter compares and contrasts the study results with previous similar studies. Limitations that were encountered during the study are also highlighted.

Chapter six gives the summary of the study. The important findings of the study are highlighted in the conclusion, and relevant recommendations related to it are proposed.



CHAPTER TWO

REVIEW OF THE LITERATURE

2.1 INTRODUCTION

This chapter is a review of the relevant literature pertaining to diabetes mellitus and physical activity among individual with diabetes. It gives a clear picture of the global burden of non-communicable diseases, with emphasis on diabetes mellitus. Furthermore, this chapter describes the management strategies for diabetes and emphasis is given on the role of physical activity both in the prevention and management of diabetes mellitus. Finally, this chapter describes different health promotion strategies aiming at the promotion of physical activity for people with and at risk of developing diabetes.

2.2 GLOBAL BURDEN OF NON-COMMUNICABLE DISEASES AND DIABETES MELLITUS

2.2.1 Non-communicable diseases

Non-communicable diseases are nowadays sweeping the entire globe, with an increasing prevalence in developing countries which have to deal with the double burden of infective and non-infective diseases in a poor environment characterized by ill-health systems (Boutayeb & Boutayeb, 2005). Non-communicable diseases (NCDs), such as heart disease, diabetes mellitus, cancer and chronic respiratory diseases are by far the leading cause of mortality in the world, representing 60% of all deaths (WHO, 2008a). Without action, an estimated 388 million of people will die from NCDs in the next 10 years (WHO, 2006c). The burden of mortality, morbidity and disability attributable to

NCDs is currently greatest and continuing to grow in the developing countries (WHO, 2004). By 2020, it is predicted that these diseases will be causing seven out of every ten deaths in developing countries (Boutayeb & Boutayeb, 2005). The projected increase in the burden of these diseases in low and middle income countries is largely driven by the underlying determinants of urbanization, globalization and rapid population ageing (WHO, 2006a). In addition, Beaglehole and Yach (2003) explained that the ageing of populations, mainly due to falling fertility rates and increasing child survival, are an underlying determinant of non-communicable disease epidemics. However, while diabetes is most common among the elderly in many populations, prevalence rates are significantly rising among comparatively young and productive populations in the developing world (IDF and WHO-AFRO, 2006). Some of the most important factors that increase the risk of NCDs include elevated consumption of energy-dense, nutrient poor foods that are high in fat, sugar and salt; reduced levels of physical activity at home, at school, at work and for recreation and transport; and use of tobacco (WHO, 2004; Beaglehole & Yach, 2003).

Health is a key determinant of development and a precursor of economic growth (WHO, 2006d; Bradshaw & Steyn, 2001). Ill health is an important cause of poverty through loss of income, catastrophic health expenses and orphanhood (Haines & Cassels, 2004). Moreover, illness and disability among the poor lead to a vicious cycle of marginalization, to falling into or remaining into poverty (Bradshaw & Steyn, 2001). Non-communicable diseases with its increasing prevalence throughout the world can cause individuals and families to fall into poverty, create a downwards spiral of

worsening poverty and disease, and undermine the macroeconomic development of developing countries (WHO, 2006c). The WHO added that NCDs represent a serious challenge to economic growth because they reduce a sizeable amount of an individual's earning potential as well as those of family members required to provide care. The focus on health and relief of poverty, as a development issue, has been central to the planning of the WHO's activities since the 51st World Health Assembly meeting in 1998 (Bradshaw & Steyn, 2001).

Later in 2004, the World Health Organization has put in place a “Global Strategy on Diet, Physical Activity and Health”. The overall goal of this strategy is to promote and protect health by guiding the development of an enabling environment for sustainable actions at all levels, in order to reduce disease and death rates related to unhealthy diet and physical inactivity (WHO, 2004). The need for such strategies is enhanced by the fact that risk factors like physical inactivity, poor diet leading to obesity, tobacco use are no more a specificity of industrialized countries; they are becoming more prevalent in developing nations, where they double the burden of infectious diseases that have always afflicted poorer countries (Boutayeb & Boutayeb, 2005). And even though there has been great progress in the treatment of NCDs and in the pharmacological control of many risk factors, from a public health point of view, the greatest potential is in influencing the risk-factors distribution in the population through general lifestyle changes, notably in diet and physical activity (WHO, 2002). This would support the overall goal of NCDs prevention and control, which is to delay mortality from these diseases to older age groups and to promote healthy ageing of global population (Strong, Mathers, Leeder &

Beaglehole, 2005).

2.2.2 Diabetes mellitus

The World Health Organization in 2006 reported that 171 million people are now suffering from diabetes worldwide (WHO, 2006e). According to Skyler and Oddo (2000), diabetes mellitus is a serious and costly public health problem affecting more than 16 million people in the United States. In Canada, 4.9 to 7% of the population over the age of 12 and 17% over the age of 64 are estimated to have diabetes (Plotnikoff, 2006). Moreover, the International Diabetes Federation (IDF, 2005) reported that the European Region with 48 million, and Western Pacific Region, with 43 million, currently have the highest number of people with diabetes. The IDF further indicated that the African continent has approximately 13.6 million people with diabetes, Nigeria having the highest number (1.2 million) of people affected. Furthermore, it is predicted that the number of people with diabetes to almost double over the next 30 years, with much of this increase occurring in developing countries, where the prevalence will rise from 4.2% to 5.6% by 2030 (Chaturvedi, 2007). Table 2.1 illustrated the worldwide prevalence of diabetes in 2000 as well as its expected prevalence for 2030 as reported by the World Health Organization (2008d).

**Table 2.1 Various countries prevalence and expected prevalence of diabetes mellitus
(WHO, 2008b)**

Country	2000	2030
Algeria	426,000	1,203,000
Nigeria	1,707,000	4,835,000
Rwanda	30,000	77,000
South Africa	814,000	1,286,000
Canada	2,006,000	3,543,000
United States of America	17,702,000	30,312,000
Brazil	4,553,000	11,305,000
France	1,710,000	2,645,000
Germany	2,627,000	3,771,000
United Kingdom of Great Britain and Northern Ireland	1,765,000	2,668,000
India	31,705,000	79,441,000
Pakistan	5,217,000	13,853,000
China	20,757,000	42,321,000
Japan	6,765,000	8,914,000
Australia	941,000	1,673,000
World Total	171,000,000	366,000,000

Diabetes mellitus is likely to remain a huge threat to public health in the years to come (Zimmet et al., 2001). Diabetes, in particular type 2 diabetes is not just a disease, but a

symptom of a much larger global problem- the effect on human health of environmental and lifestyle changes (Astrup & Finer, 2000). Its incidence will continue to grow as indicated by higher rates of impaired glucose, obesity and the trends toward more sedentary lifestyle (Skyler & Oddo, 2000). Traditional activities and dietary patterns that have sustained people over generations are rapidly disappearing and the socioeconomic situation in many countries has forced people to move to urbanized areas to seek employment, where they are less likely to lead a healthy lifestyle (Khatib, 2006). Similarly to the above phenomenon about lifestyle behaviour changes, such changes are also occurring in Rwanda (Tumusiime, 2004). The author further explained that following the 1990-1994 civil war, many Rwandan people who were living in exile as refugees returned to the country, and came to settle in urban areas for job opportunities and security reasons. Rural to urban migration in developing countries are well known to lead to changes in lifestyle and that living or working in an urban environment increases sedentarism (Torun, et al., 2002), which in turn is strongly associated with the increasing prevalence of type 2 diabetes mellitus.

Diabetes is a costly disease in terms of morbidity, mortality and quality of life (Khatib, 2006). The burden of this metabolic disease is exacerbated by long-term complications, including peripheral and central neuropathies, amputations, retinopathy, ketoacidosis, kidney failure, as well as cardiovascular diseases which are responsible for between 50 and 80% of deaths in people with diabetes (Boutayeb & Boutayeb, 2005; Frier, Bruce, Yang & Taylor, 2006). Moreover, diabetes quite commonly affects the musculoskeletal system, resulting in significant morbidity most commonly in people with a longstanding

history of type 1 diabetes (Kim, Edelman & Kim, 2001). All cause mortality is three to four times greater in the diabetes population; hence appropriate management is of timely importance, particularly with a projected prevalence increase of 134% within the next 25 years among individuals over the age of 65 years (Frier et al., 2006).

2.3 MANAGEMENT OF DIABETES MELLITUS

The two major types of diabetes are type 1, previously known as insulin-dependent diabetes mellitus or juvenile-onset diabetes, and type 2, formerly called non-insulin-dependent diabetes mellitus or adult-onset diabetes (WHO, 2008e).

Type 1 diabetes is caused by an auto-immune reaction where the body's defense system attacks the insulin-producing cells (IDF, 2006b). The IDF further explained that people with this form of diabetes need injections of insulin every day in order to control the levels of glucose in their blood.

Type 2 diabetes is the most common form of diabetes and is characterised by hyperglycaemia resulting from a combination of peripheral and hepatic insulin resistance and impaired insulin secretion (Stumvoll, Goldstein & Van Haefen, 2005). People with type 2 diabetes are not dependent on exogenous insulin, but may require it for control of blood glucose levels if this is not achieved with lifestyle changes or with oral hypoglycemic agents (Zimmet et al., 2001).

Diabetes is a chronic progressive disease that usually requires lifestyle changes, especially in the areas of nutrition and physical activity (Stys & Kulkarni, 2007).

The management of diabetes is complex, typically requiring individual with diabetes to make changes to lifestyle factors such as diet, physical activity and weight control, take multiple oral agents or insulin and self-monitor blood glucose (Calvert, Shankar, McManus & Freemantle, 2008). However, despite the great strides that have been made in the management of diabetes in recent years, many people with diabetes do not achieve optimal outcomes and still experience devastating complications that result in a decreased length and quality of life (Funnel & Anderson, 2004).

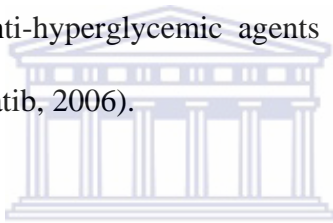
2.3.1 Diet

Diet plays a critical role in the development of many conditions including type 2 diabetes, cardiovascular diseases, cancer, dental diseases and osteoporosis (Food and Agriculture Organization of the United Nations, 2004), and is considered as an essential component of diabetes management (Hunking, 2006). The primary goal with respect to dietary fat in individuals with diabetes is to limit both saturated fatty acids and trans fatty acids, which are the principal dietary determinants of plasma LDL cholesterol as well as to limit cholesterol intake so as to reduce risk for CVDs (American Diabetes Association, 2008). General recommendations encourage the consumption of a variety of fruits, vegetables, grains, low-fat dairy products, fish, poultry, and lean meat (Fowler, 2007)

2.3.2 Drug therapy

Drug therapy for diabetes is not only about controlling blood glucose, but also about the overall control and reduction in the risk factors for diabetic complications, which includes the control of blood pressure and blood lipids (WHO, 2006f). People with type 1

diabetes require multiple daily insulin injections for survival, while type 2 diabetes individual may require oral hypoglycemic drugs to lower their blood sugar and some may need insulin injections at some point. The goal of insulin administration is to normalize blood glucose levels, whether a patient has type 1 or type 2 diabetes (Fowler, 2008). He added that normalization of glucose levels decreases patients' risk of developing microvascular complications in type 1 or type 2 diabetes and has also been shown to decrease the risk of developing macrovascular complications in type 1 diabetes. However, type 2 diabetes drug therapy gives emphasis on diet, weight management and healthy lifestyle in order to control hyperglycemia, and if this regimen does not lead to adequate blood glucose control, oral anti-hyperglycemic agents and/or insulin will have to be integrated in the treatment (Khatib, 2006).



2.3.3 Diabetes self-management education

In order for people with diabetes to become actively involved in their own care, it is important for them to be equipped with the information needed for effective self-management (Meetoo & Gopaul, 2005). Education has long been recognised as an important part of the diabetes management regimen (Colberg, 2008). Therefore, the Diabetes self-management education (DSME) has been identified as an essential component of diabetes care. It helps people with diabetes start their diabetes self-care effectively when they are initially diagnosed, and on an ongoing basis helps them continue a high-quality level of self-care that is essential for optimising metabolic control, managing complications, and having an acceptably high quality of life (Kulkarni, 2006). Furthermore, the benefits of DSME are extended to society as a whole in terms of

reduced healthcare spending when people are able to effectively manage their own condition, improve overall health and well-being, and thus reduce the risk of complications (Peeples, Koshinsky & Mc Williams, 2007). To the same opinion, Kulkani (2006) stated that inadequate diabetes self-management contributes to reductions in the health and well-being of people with diabetes.

However, people with diabetes worldwide encounter many obstacles in attempting to follow therapeutic regimens (Peeples et al., 2007). They added that education that acknowledges the cultural background of people with diabetes and their ability to understand information on health can improve their ability to follow a treatment routine. The authors further explained that educational programmes should be designed with appropriate strategies that address these areas as well as each person's readiness and confidence to learn a skill, identify a need for change, and collaboratively set goals for making such changes. Knowledge about diabetes, dietary composition (particularly with regard to reducing saturated fats), their impact on blood glucose levels, as well as the effect of other lifestyle issues such as physical activity, smoking cessation, limited alcohol intake are relevant topics which should be part of the education program (Meetoo & Gopaul, 2005).

2.3.4 Monitoring and prevention of complications

Once the diagnosis is made, emphasis should be given to secondary and tertiary prevention (Sambo, 2007). According to Khatib (2006), secondary prevention is the key to reducing the risk of disabling and costly diabetic complications. The author further

explained that tertiary prevention of diabetes is also of great importance, and includes every action taken to prevent or delay the consequences of diabetic complications, such as blindness, renal insufficiency, foot amputation and adverse pregnancy outcomes.

2.4 ROLE OF PHYSICAL ACTIVITY IN THE PREVENTION AND THE MANAGEMENT OF DIABETES

2.4.1 Physical activity in the primary prevention of diabetes mellitus

Physical inactivity, (a lack of physical activity) is an important risk factor for chronic diseases, and overall is estimated to cause 1.9 million deaths globally (WHO, 2004; Blair & Church, 2003). Physical inactivity is one of the living habits that have been shown to be causally related to the most common metabolic and cardiovascular conditions, namely obesity, type 2 diabetes, metabolic syndrome, hypertension, coronary heart disease, stroke and peripheral arterial disease (Vuori, 2007). The evidence linking physical inactivity to the future risk of type 2 diabetes is strong, and modification of behaviour is a critical and effective element of strategies aimed at the prevention of this increasingly prevalent disorder (Wareham, 2007). There is now compelling evidence from randomized control trials showing that type 2 diabetes can be prevented by lifestyle changes, both in developed societies (Tuomilehto et al., 2001) and in the developing countries (Ramachandran et al., 2006). A study done in South Africa has also recommended that physical activity be part of a treatment regime for individuals with type 2 diabetes mellitus (Van Rooijen, Rheeder, Eales and Molatoli, 2002).

According to the American Diabetes Association (2005), moderate weight loss and

increased physical activity can prevent or delay the development of type 2 diabetes in high-risk groups. Prediabetes is the term used to distinguish people who are at increased risk of developing type 2 diabetes. People with prediabetes have impaired glucose tolerance (IGT) or impaired fasting glucose concentrations (IFG), or sometimes both IGT and IFG (Hunking, 2006). In addition to people with prediabetes, other individuals at risk of developing diabetes are those with obesity, dyslipidemia, hypertension, familial diabetes and gestational diabetes (Andersson, Ekman, Lindblad & Friberg, 2008).

Data from the Diabetes Prevention Program (DPF) demonstrated that weight loss and increased physical activity (150 min of brisk walking per week) reduced the 4-year incidence of type 2 diabetes by 58% in men and women with impaired glucose tolerance (American Diabetes Association, 2003a). To the same opinion, Knowler et al. (2002) and Tuomilehto et al. (2001) in their respective studies explained that lifestyle changes were nearly twice as effective as metformin therapy (31% reduction in incidence of diabetes) in preventing type 2 diabetes. In another similar study conducted in South India, lifestyle measures were again shown to be highly effective in reducing the incidence of diabetes (Ramachandran, Snehalaha, Mary, Mukesh, Bhaskar & Vijay, 2006). Furthermore, a study done by Hu et al.(2004) indicated an association between physical activity and risk of type 2 diabetes not only in nonobese subjects with normal glucose regulation, but also in subjects with either obesity or impaired glucose regulation, or in subjects with both obesity and impaired glucose regulation. Table 2.2 summarizes various randomized clinical trials of exercise/diet and incidence of type 2 diabetes (Bassuk, & Manson, 2005). Moreover, figure 2.1 indicates the relative risk of type 2 diabetes according to the levels

of physical activity, body mass index, and glucose tolerance status, as highlighted in a study done by Hu et al. (2004).

Both aerobic and resistance types of exercise have been shown to be associated with a decreased risk of type 2 diabetes (Warburton, Nicol & Bredin, 2006). However, resistance training may have greater benefits for glycemic control than aerobic training may have (Dunstan et al., 2005).

The rate of diabetes has increased in parallel with the rate of obesity over the past decade, and it is well recognised that risk for diabetes increases as the degree of overweight increases (Mokdad, Bowman, Ford, Vinicor, Marks, Koplan, 2001). According to the American Diabetes Association (ADA, 2005), overweight and obesity are strongly linked to the development of type 2 diabetes and can complicate its management. They added that obesity complicates the management of type 2 diabetes by increasing insulin resistance and blood glucose concentration. In addition, obesity is also an independent risk factor for dislipidemia, hypertension, and cardiovascular disease and thus increases the risk of cardiovascular complications and mortality in patients with type 2 diabetes (Field et al., 2001). Given the rates of obesity and type 2 diabetes and the contribution of a sedentary lifestyle on these diseases, it is crucial therefore, to properly educate obese patients and patients with glucose tolerance or impaired fasting glucose about the significance of regular physical activity and weight loss in preventing diabetes, especially because many individual with diabetes may make the presumption that medical therapy is the more important approach in preventing diabetes (Fowler, 2007; Zacker, 2005).

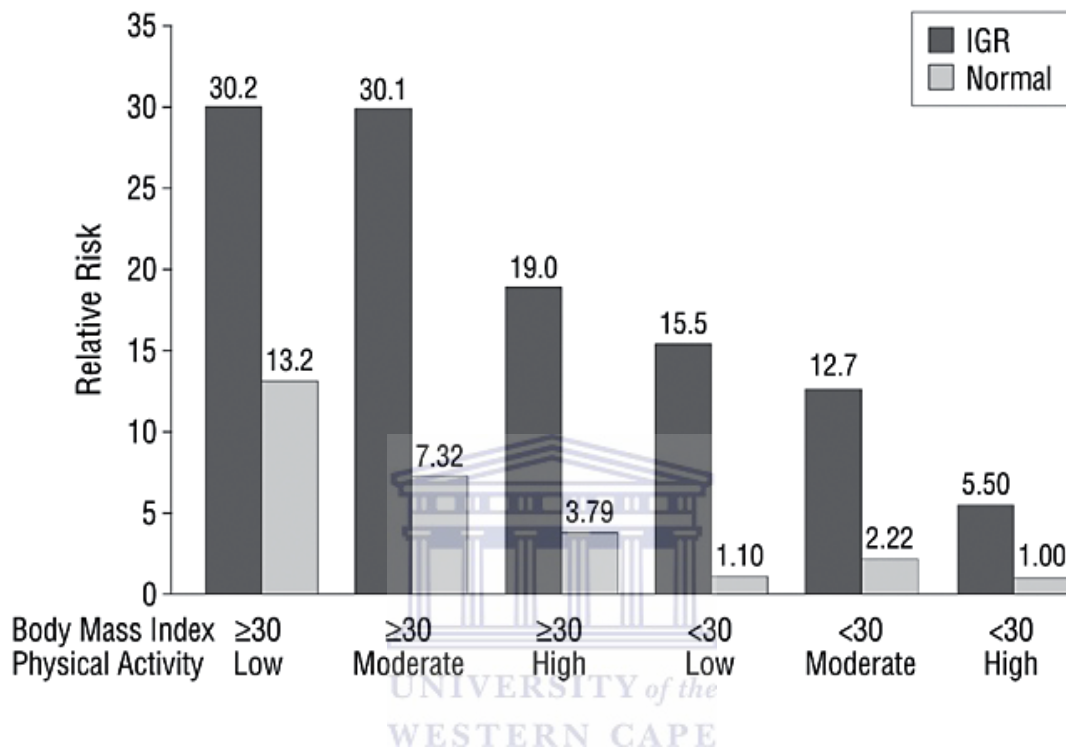


Figure 2. Relative risk of type 2 diabetes according to various levels of physical activity (low, moderate and high), body mass index, & glucose tolerance status. IGR indicates impaired glucose regulation while normal indicates a normal plasma glucose level (Hu et al., 2004).

**Table 2.2 Randomized clinical trials of exercise/diet and incidence of type 2 diabetes
(Bassuk & Manson, 2005)**

Study	Study population	Intervention(s)	Length-year	Reduction in Risk of type 2 Diabetes in Intervention Group(s) Compared With Control Group
Da Qing Impaired Glucose Tolerance and Diabetes Study [Pan et al. (77)]	577 men & women with impaired glucose tolerance; mean age: 45 yr mean BMI:25.8kg/m ²	Diet only; exercise only; diet plus exercise; control	6	Diet only: 31% (<i>P</i> < 0.03) Exercise only: 46% (<i>P</i> < 0.0005) Diet plus exercise: 42% (<i>P</i> < 0.005)
Finnish Diabetes Prevention Trial [Tuomilehto et al. (99)]	522 men & women with impaired glucose tolerance mean age: 55 yr mean BMI: 31 kg/m ²	Lifestyle modification program (goal of weight loss \geq 5%; diet composed of <30% kcal from fat, <10% kcal from saturated fat, and \geq 15 g fiber/1,000 kcal; moderate-intensity exercise \geq 30 min/day) or control	3.2	58% (<i>P</i> < 0.001)
US Diabetes Prevention Program [Knowler et al. (52)]	3,234 men & women with elevated fasting and postload glucose; mean age: 51 yr mean BMI: 34 kg/m ²	Lifestyle modification program (goal of weight loss \geq 7% & exercise \geq 150 min/wk); or metformin (850 mg twice daily); or placebo	2.8	Lifestyle modification: 58% (95% CI, 48–66%) Metformin: 31% (95% CI, 17–43%)

2.4.2 Physical activity in the management of diabetes mellitus

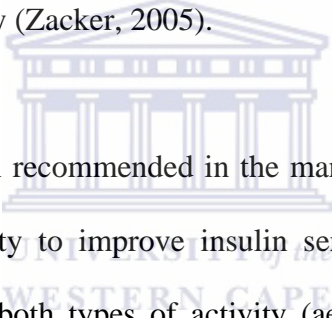
Lifestyle modifications are not just beneficial before the development of diabetes, and several studies have clearly demonstrated the benefit of a healthy diet, regular physical activity and weight control in individuals already diagnosed with diabetes (Fowler, 2007). According to Maffuli, Chan, MacDonald, Malina and Parker (2001) physical activity, at a reasonable level, is one of the most beneficial aspects in diabetes care. Regular physical activity is often recommended for individuals with diabetes for its beneficial effects on the metabolic risk factors often associated with diabetes complications (Deshpande et al., 2005). Physical activity increases insulin sensitivity, lowers insulin dosage, prevents and control comorbidities and complications, and improves the quality of life (Shahar, 2008; Blair & Church, 2003). Moreover, physical activity is a key determinant of energy expenditure, and thus is fundamental to energy balance and weight control (WHO, 2004). The mechanism by which physical activity improves insulin sensitivity may involve increased insulin delivery because of improved blood flow to muscle, increased level and translocation of muscle glucose transporter (GLUT-4), and increased glycogen synthase activity, which results in increased glycogen synthesis and glucose disposal (Hu et al., 2004). Furthermore, the authors explained that physical activity also improves insulin sensitivity by reducing the adipose tissue mass.

All levels of physical activity, including leisure, transportation and households activities as well as recreational sports, and competitive professional performance are advised and can be performed by people with diabetes, mostly to those who do not have complications and have good glucose control (American diabetes association, 2003).

In order to improve the control of glucose, maintain a healthy weight and lower the risk of heart disease, it is recommended that most people with diabetes accumulate at least 150 minutes of moderate-intensity physical activity such as brisk walking, bicycling, or swimming, each week (Schrauwen, 2007). Thus, patients with diabetes should be encouraged to perform 30–60 min of moderate-intensity aerobic activity such as brisk walking on most (preferably all) days of the week, supplemented by an increase in daily lifestyle activities (e.g., walking breaks during the workday, gardening, and household work) (Buse et al., 2007). Alternatively, people with diabetes can aim for 90 minutes a week of more vigorous activity, such as jogging or high-impact aerobics (Marks, 2005). However intense the activity, people with type 2 diabetes should engage in physical activity on at least 3 days of the week and should not go more than 2 days in a row without getting any physical activity (Joy, 2007). Furthermore, regular physical activity of any type and intensity is the key to effective blood glucose control because the heightened insulin action in exercised muscle persists for only 1-2 days (Colberg, 2008).

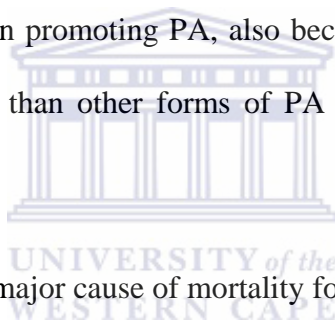
A new promising new recommendation for those with diabetes is resistance training (Plotnikoff, 2006). Strength training has been demonstrated to be safe and effective in patients with chronic diseases, including diabetes and CVD (Zacker, 2005). The Canadian Diabetic Association, the American College of Sports Medicine and the American Diabetic Association have recently updated their physical activity recommendations to include this important modality of physical activity for people with diabetes (Plotnikoff, 2006). Progressive resistance training, in which the resistance is gradually increased over time leads to gains in muscle mass; and it is this increase,

irrespective of fat loss that is thought to cause the improvement in glucose disposal rate, glycogen storage capacity, insulin sensitivity and glucose tolerance (Castaneda et al., 2002). In addition, a major appeal of resistance training as a form of diabetes treatment is its applicability for those with mobility limitations (Willey & Singh, 2003). As a significant number of adults with type 2 diabetes have decreased mobility due to excess weight, foot ailments and poor balance, lifting weights or performing other forms of resistance training can provide a safe physiological stimulus with few complications (Plotnikoff, 2006). However, absolute contraindications to strength training include unstable angina, uncontrolled hypertension, uncontrolled dysrhythmias, cardiomyopathy and certain stages of retinopathy (Zacker, 2005).



Aerobic exercise has long been recommended in the management of type 2 diabetes, in large part because of its ability to improve insulin sensitivity and glucose tolerance (Zacker, 2005). Incorporating both types of activity (aerobics and resistance training) appears to take advantage of differing mechanisms of action, enhancing insulin sensitivity and glucose disposal further than either activity could achieve alone (Cuff, Meneilly, Martin, Ignaszewski, Tildesley & Frohlich, 2003; Zacker, 2005). However, as stated by Zacker (2005), aerobic activities (such as brisk walking) will, likely remain the most recommended mode of exercise. The author further explained that this is because aerobic activities are safe, require little skill, no specific equipment and can be performed anywhere, therefore facilitating participation. In general, people with diabetes will be more likely to engage in physical activities that they enjoy, feel good about doing, and can do without purchasing special equipment (Stys & Kulkarni, 2007). The authors

further explained that for most individuals with diabetes, a walking program has been shown to be the preferred choice of physical activity. In a recent study on adult women, regular, moderate (brisk) walking decreased their risk for developing diabetes similarly to engaging in more vigorous activity, demonstrating that intensity may not be as important as regular participation in any activity (Colberg, 2008). Similarly, a prospective cohort study of adults individuals with diabetes showed that compared with inactive individuals, those who walked at least 2 hours/week had a 39% lower all-cause mortality rate, and a 34% lower cardiovascular diseases mortality rate (Gregg, Gerzoff, Casperson, Williamson & Narayan, 2003). Walking would therefore seem to be an appropriate mode of physical activity to use when promoting PA, also because it is likely that walking be associated with fewer barriers than other forms of PA (Johnson, 2000 cited in Yates, Khunti & Davies, 2007).



However, because CVD is the major cause of mortality for people with diabetes, a careful medical evaluation should be performed before increasing usual patterns of physical activity, or starting an exercise program (American Diabetes Association, 2003b; Mulloly & Kemmis, 2005). The examination will assess the presence of conditions that might contraindicate certain types of exercise or predispose to injury, such as uncontrolled hypertension, severe autonomic neuropathy, severe peripheral neuropathy or history of foot lesions, and advanced retinopathy (American Diabetes Association, 2008). They added that the patient's age and previous physical activity level will also be considered. The medical examination should also carefully screen for the presence of macro- and microvascular complications that may be worsened by physical activity or exercise program (Press, Freestone & George, 2003). Furthermore, blood glucose monitoring may

need to be performed before, during, and after activity to determine the need for insulin adjustments and prevent hypoglycaemia or hyperglycemia (Mulloly & Kemmis, 2005; Shahar, 2008). People with diabetes should consider delaying physical activity or exercise if their blood glucose is $>250\text{mg/dl}$ and ketones are present or if their blood glucose level is $>300\text{mg/dl}$ (Fowler, 2007). In type 1 individual with diabetes, who lack endogenous insulin, the risk of hypoglycaemia during physical activity is more severe (Schrauwen, 2007). Therefore, as the author further explained, type 1 diabetic people need to take precautions, such as reducing pre-physical activity insulin levels, adjusting carbohydrate intake before or during physical activity, and avoiding physical activity or exercise after a hypoglycaemic event. In addition, people with type 1 diabetes must be particularly careful to avoid exercising and creating increased need for energy by the muscles when glucose levels are very high because this may lead to ketoacidosis (Shahar, 2008). According to Khatib (2006), diabetes ketoacidosis remains a potentially lethal condition with mortality as high as 10-15%; however, at least 50% of cases are avoidable. He further explained that ketoacidosis occurs when the body breaks down fatty acids and produces ketones, which are acidic- some of the ketone bodies are lost through the urine, but those that remain build up in the blood and lead to ketoacidosis.

Despite its greater role as one of the cornerstones of diabetes management, physical activity remains by far the most underused (Colberg, 2008). People with diabetes often report that making lifestyle changes is one of the greatest challenges they face in managing their diabetes (Stys & Kulkarni, 2007). Many individuals with diabetes face barriers to become active, even when they understand all the benefits of physical activity. Indeed, a recent population-based study found that only 28% of individuals with type 2

diabetes achieve the recommended levels and frequency of physical activity (Eves & Plotnikoff, 2006). Health care professionals would therefore be of great importance in motivating and helping patients overcome barriers to physical activity, as well as in helping them create an physical activity routine that is specific to their health status, age, current exercise capacity, glycemic control and personal goals (Shahar, 2008; Stys & Kulkarni, 2007).

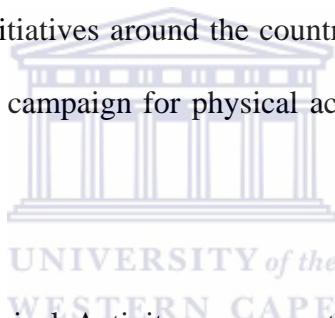
2.5 PHYSICAL ACTIVITY HEALTH PROMOTION PROGRAMMES

Even though there has been great progress in the treatment of non-communicable diseases and in the pharmacological control of many risk factors, from a public health point of view, the greatest potential is in influencing the risk-factors distribution in the population through general lifestyle changes, notably in diet and physical activity (WHO, 2002). Moreover, promoting healthy lifestyle is a cost-effective and sustainable way for controlling non-communicable diseases (Howard et al., 2002; WHO, 2002).

The World Health Organization in 2002, through the slogan “Move for Health” chose physical activity as the theme for its World Health Day in order to promote healthy, active and smoke-free lifestyles and prevent the disease and disability caused by unhealthy and sedentary living (Yach, 2002). The author further explained that this slogan was an urgent call for individuals, communities and countries to associate action for health with the public health task of prevention. The implementation of the WHO Global Strategy focusing on diet, physical activity, tobacco control, and prevention of harmful use of alcohol is considered as a key element in diabetes prevention (Sambo, 2007). Some countries such as Brazil further adopted the WHO Global Strategy on Diet,

Physical Activity and Health since 2004, to promote healthy lifestyle through regular physical activity, healthy diet and tobacco control (Buss, 2006).

Developing countries such as Sri Lanka, China, Mauritius, Pakistan and South Africa initiated physical activity interventions as part of the implementation of a national action plan or strategy for NCDs prevention and control, health promotion, or physical activity promotion in particular (Bauman, Schoeppe, Lewicka, Armstrong, Candeias & Richards, 2005). They further explained the action of South Africa in 2005, which has initiated a campaign called “Vuka South Africa-Move for your health”, whose aim is to promote sustainable physical activity initiatives around the country. Move for your Health sets a good example of a nationwide campaign for physical activity and health in the African continent.



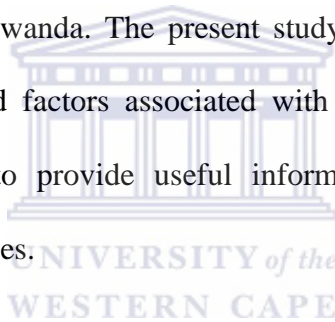
In Sri Lanka, a Diet and Physical Activity component is integrated into the Healthy Lifestyle Programme. Its implementation takes place mainly in the school setting, thereby targeting children and youth and aiming at a 20-min early morning exercise programme, dissemination of health messages in school clubs, as well as training of school teachers on physical activity and health (Bauman et al., 2005). They added that in addition to those programs initiated in schools, outside the school setting, "Move for Health" programmes are arranged for youth clubs, and education materials such as leaflets and CD Roms on regular exercises) are disseminated at youth programs and seminars.

Several countries have implemented strategic plans aiming at reducing the impact of diabetes mellitus through lifestyle changes. The Strategic Plan for Diabetes in South Australia was published in 1999 and updated in 2003 by the Diabetes Strategic Management Group (DSMG), which provides leadership and co-ordination for diabetes in South Australia (Wanders & Wilson, 2000). This plan overall aim is to reduce the impact of diabetes in South Australia. With regards to the promotion of physical activity, one of the key action area of the Australian strategic plan 2003-2006 is to improve the level of support for people with type 2 diabetes risk factors to encourage regular physical activity; and in general, to maintain a healthy weight or lose weight if overweight, eat a healthy diet; and remain non-smokers or stop smoking (Wanders & Wilson, 2000). Moreover, Australian's action on the priorities of physical activity and nutritious food is guided by the 'Go for your life' Strategic Plan 2006–2010, which outlines a whole of government vision for healthy and active communities, prioritizing key settings and population groups (IDF, 2007). Australia has also developed another program, “Life! Taking Action on Diabetes” which is a new, community-based lifestyle behaviour change program for Victorians 50 years and over, and Aboriginal Victorians of all ages who are identified as at high risk of developing type 2 diabetes (IDF, 2007). The program supports participants to work towards three key goals: healthy diet, control of weight and regular physical activity aiming at 30 minutes/day of moderate intensity physical activity. A social marketing campaign is done to encourage risk assessment and recruitment within the targeted populations and promote awareness across the State of the risk and seriousness of type 2 diabetes (IDF, 2007). Furthermore, regular health- enhancing physical activity can effectively be promoted by combining different strategies and acting

simultaneously in different setting (Miilunpalo, 2001). The author further explained that this is because physical activity promotional activities are mostly needed where people live and work.

2.5 Summary

As the literature review indicates, physical activity plays an important role in both prevention and management of diabetes mellitus. Through the review however, it is clear that physical activity remains by far the most underused. This highlights the great need for the implementation of strategies aiming at reducing the impact of diabetes mellitus through lifestyle changes in Rwanda. The present study whose aim is to establish the levels of physical activity and factors associated with it among adults with diabetes mellitus is therefore hoped to provide useful information that would help in the implementation of such strategies.



CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter details the methods used in carrying out the present study. A clear description of the research setting, as well as the study design, the study population and the sampling technique is given. The chapter also describes the pilot study, the data collection procedures, and the methods used in the data analysis. Finally, the issues of ethical considerations are also reported.

3.2 RESEARCH SETTING

The study was conducted at the Rwandan Diabetic Association (RDA) specialized clinic called “La Fraternité”. The clinic is situated in Kigali, the capital city of the Republic of Rwanda. Rwanda is a landlocked country situated in central Africa. Also known as “the land of a thousand hills” the country is bordered by Uganda to the north, Tanzania to the east, Burundi to the south and the Democratic Republic of Congo to the West (Wikipedia, 2008).

The RDA clinic has been created after the 1994 genocide which has caused damage to the healthcare infrastructures as well as a shortage in trained medical personnel (Gishoma, 2005). The clinic provides 24-hour care for people with diabetes mellitus and aims at the prevention, promotion, treatment and rehabilitation of diabetic patients. A team composed of nurses, a cardiologist, a general practitioner and a laboratory analyst work together to ensure the care of people with diabetes mellitus. The RDA clinic

receives funds from various local and international organizations, which are mainly allocated for essential drugs, therefore providing insulin and hypoglycemic agents at affordable prices. A leaflet was published by the clinic to provide basic information on diabetes, and was distributed free of charge in different settings as an attempt to save the lives of people who otherwise might not have their symptoms recognized due to the lack of diabetes awareness in the country (Gishoma, 2005). The RDA clinic was chosen as the study setting because it is a specialized clinic in diabetes mellitus. In addition it receives the biggest number of diabetic patients who come for treatment and follow up care from all-over the country, both rural and urban areas.

3.3 STUDY DESIGN

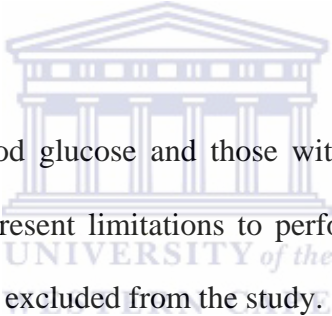
A descriptive quantitative study was carried out to describe the levels of physical activity participation and their association with the socio-demographic and health related factors among adults with diabetes mellitus. A cross sectional study was used to collect information at a point in time. According to Babbie (2004), a cross-sectional study involves observations of a sample, of a population or phenomenon that are made at one point in time. For this study, this design was used to measure the levels of physical activity participation among adults with diabetes mellitus at the moment of data collection. In addition, this design was used due to the limited time frame for collecting data.

3.4 STUDY POPULATION AND SAMPLE

The population of the study included all adult diabetic patients aged 18 and older who receive treatment and follow up care at the RDA clinic. Both males and females who voluntarily agreed to participate in the study were eligible. Approximately 390 adults aged 18 years and older attend the RDA clinic on a monthly basis. Yamane's formula

$$n = \frac{N}{1 + N(e^2)}$$
 was used to calculate the sample size as recommended by Israel (1992),

where n stands for sample; N for study population and e is equal to 0.05. By use of the above formula, a sample size of 193 patients was calculated to be appropriate for the study.



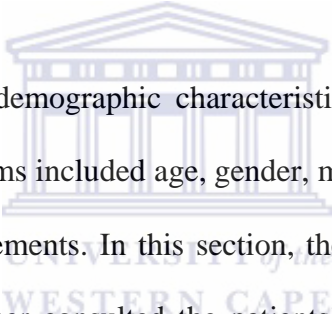
Patients with uncontrolled blood glucose and those with physical impairments or any other impairment that may represent limitations to perform a physical activity such as severe vision impairments were excluded from the study.

A systematic random sampling technique was used to ensure equal chance of selection among participants. Considering that the study population (390) was twice the number of the targeted sample size (193), participants were randomly selected by considering every 2nd patient who was coming for treatment or follow up care at the RDA clinic with respect to the exclusion criteria. A final number of 156 adults with diabetes mellitus of which 83 (53.2%) were female and 73 (46.8%) were male voluntarily agreed to participate in the study.

3.5 DATA COLLECTION

3.5.1 Instruments

Data was collected by means of a structured, self administered questionnaire (Appendix I & J). The advantage of self administered questionnaires is that respondents can be helped to overcome difficulties with the questions, and it allows a high response rate fairly quickly (Walliman, 2006). Attached to the questionnaire was an explanation letter of the aim of the study, as well as the consent form which had to be signed by the participants to ensure their voluntary participation in the study. The questionnaire consisted of 5 sections which were composed of closed ended questions.



Section A assessed the socio-demographic characteristics of the participants and was composed of 8 items. These items included age, gender, marital status, level of education, and height and weight measurements. In this section, the type of diabetes mellitus was also included, and the researcher consulted the patients' medical reports to ensure the validity of the diagnosis on the type of diabetes mellitus.

Section B assessed the participants' perception regarding their health status and was measured by a single item "How would you rate your overall health at the present time?" To this question, the respondents were asked to rate their health as poor, fair, good or as very good.

Section C measured the participants' self-efficacy for diabetes. This section aimed at identifying how confident respondents were in dealing with diabetes mellitus in their

activities of daily living. This section was composed of 8 questions which participants were requested to score. The scores ranged from 1 (as not confident at all) to 10 (as totally confident).

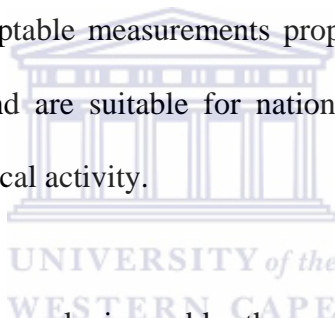
Section D measured the levels of physical activity by use of the International Physical Activity Questionnaire (IPAQ). It consisted of 15 questions which assessed the different categories of physical activities, such as work-related, transport-related, and leisure-time-related physical activities. Participants had to indicate their frequency of participation as well as their duration of participation in these physical activities.

The last section (E) assessed the possible barriers to physical activity and consisted of 2 questions. The first question assessed if participants were prevented from being physically active. They could respond with either “yes” or “no”. The second question listed possible barriers to physical activity and participants were requested to tick one or more factors that may have kept them from being physically active.

3.5.2 Validity and reliability

Validity refers to the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration (Babbie & Mouton, 2005). They further explained the concept of reliability which is a matter of whether a particular technique applied repeatedly to the same object would yield the same result each time. Therefore to ensure validity and reliability, the items used in the current questionnaire was adapted from other questionnaires which were used in prior research related to physical activity.

Firstly, participants' perception regarding their health status was measured by a single item which have been used in prior research, and whose validity was supported by Idler and Benyamini's (1997) summary of 27 studies that identified self-reported health as a significant predictor of mortality among adults. The self- efficacy for diabetes scale has been used in a prior research on adults with diabetes mellitus, and has shown an internal consistency reliability of 0.828. Lastly, the levels of physical activity participation were assessed by using the International physical activity questionnaire (IPAQ). The IPAQ was first used in Geneva in 1998 and was followed by extensive reliability and validity testing undertaken across 12 countries during 2000 (Craig et al., 2003). They concluded that these measures have acceptable measurements properties for use in many settings and in different languages, and are suitable for national population-based prevalence studies of participation in physical activity.



One common language, Kinyarwanda, is used by the majority of Rwandan people as the national language. The questionnaire was therefore translated from English to Kinyarwanda by a professional translator. To further ensure the validity of the instrument, the Kinyarwanda questionnaire was then back-translated into English by an independent translator. The second version has shown to be similar to the original English version of the questionnaire.

To further ensure validity, the questionnaire was given to the medical personnel of the RDA specialized clinic for their views and suggestions with regards to the clarity of the questionnaire and the objectives to be met. Furthermore, a pilot study was carried out at

RDA specialized clinic on 15 diabetic patients who were not included in the study. The aim of this pilot study was to test the understanding, clarity, reliability of the questionnaire so as to consider if the questionnaire should be subjected to any change considering the information collected prior to the data collection. In the pilot study, out of 15 patients, only 5 reached secondary school. This gave an idea of the expected level of education and the possible need for assistance during completion of the questionnaire. Therefore, the researcher was present when participants completed the questionnaire. This ensured that the researcher were present if any questions needed to be clarified. Furthermore, it was highlighted during the pilot study that the original question on barriers to physical activity was difficult to answer, as it was an open ended question. A request from the participants was to include possible common barriers they could select hence easing the question. A retest was then done to ensure the stability and consistency of the respondents answers. Finally, clear and precise instructions were given to the participants prior to the completion of the questionnaire to ensure their understanding of the questions.

3.5.3. Procedure

Permission and ethical clearance were first requested and obtained from the Senate Research Grant and Study Leave committee at the University of the Western Cape (UWC) (Appendix A). Permission was also obtained from the Ministry of Health, Rwanda (Appendix B). Furthermore, authorization to conduct the study at the RDA clinic was sought from the President of the Rwandan Diabetic Association (Appendix C). Prior to data collection, a meeting was organized with the medical team to discuss the purpose

of the study, the sampling techniques to be used as well as the inclusion and exclusion criteria to be taken into consideration. The purpose of the meeting was to get a clear and common understanding of the data collection process especially from the medical doctor who had to refer the patients to the researcher after consulting them. One week before data collection, a notice was posted at the entry of the clinic explaining the purpose of the study, and requesting the patients to participate in the study. The process of collecting data took 6 weeks. A room was assigned for the researcher and every 2nd patient who agreed to participate in the study was sent by the doctor at the end of the consultation. The information letter (Appendix G and H) as well as the consent letter (Appendix E and F) was then given to the participants, prior to the distribution of the questionnaire and participants were requested to return a signed consent form. In addition, measurements of height and weight of the participants were taken by the researcher before participants' completion of the questionnaire. All measurements were taken twice to ensure reliability, and an average of the two readings was used.

3.6. DATA ANALYSIS

Completed data was first captured on spreadsheet using the Microsoft Excel program in preparation for analysis. The data was then transferred into the Statistical Package for the Social Sciences (SPSS) version 15.0. In order to meet the purpose of the study which identify the levels of physical activity participation among adults with diabetes mellitus and examine their association with demographic, social and health related factors, both descriptive and inferential statistics were carried out.

Descriptive statistics were employed to summarize the levels of physical activity and the demographic, social as well as the health related factors. Categorical data were expressed as frequencies and percentages, means and standard deviations were used for continuous data. Furthermore, cross-tabulations were used to determine the association between socio-demographic, health related factors and physical activity levels among adults with diabetes mellitus. For categorical data, Chi-squares tests were carried out to test for any significant associations. Student t-tests were used to tests for significant associations in the case of continuous variables. Alpha level was set at $p < 0.05$. The results are presented by means of tables, histograms, pie chart and graphs.

3.7. ETHICAL CONSIDERATION

After the approval of the Senate Research Grant and Study Leave committee of the UWC, the researcher requested authorization from the Rwandan Ministry of Health. Once obtained, permission was again sought from the President of the Rwanda Diabetic Association. In the permission letter, the researcher included clear explanation of the study and its objectives. Prior to the completion of the questionnaire, written information on the study and its aim as well as a consent letter were given to each participant. Those who were willing to participate in the study were asked to mark their approval by signing and returning it back to the researcher. Participants were ensured of the anonymity and the confidentiality of the information provided as well as their right to withdraw from the study at anytime without giving a reason or being negatively affected. The Researcher will make the research findings available to the participants, the Rwanda Diabetic Association as well as the Ministry of Health.

3.8 Summary

In this chapter, the method used in the study, sampling procedures and explanation of the instruments used were outlined. A brief explanation of the data analysis procedure was given. The results of the analysis were tabulated and are presented in Chapter 4.



CHAPTER 4 RESULTS

4.1 INTRODUCTION

This chapter presents the results of the study with regards to its objectives and overall aim. The descriptive results mainly present the socio-demographic and health related factors while the inferential results highlight the association between the variables stated above and the levels of physical activity among adults with diabetes mellitus.

4.2. DESCRIPTION OF THE STUDY SAMPLE

A total number of 156 participants with diabetes mellitus from the Rwanda Diabetic Association's specialized clinic in Kigali, Rwanda voluntarily agreed to participate in the study. Of the 156 respondents, 46.8% (n=43) were males and 53.2% (n=83) were females. The participants age ranged from 18 to 83 years, with the mean age for both gender being 48 years (SD=14.7). Most of the participants (58.5%, n=91) were married and had a primary school level education (41%, n=64) as illustrated in Table 4.1.

The Body Mass Index (BMI) was calculated from measured height and weight for the participants in the study. The sample was divided into four categories according to their BMI, i.e. underweight (<18.5), normal (18.5-24.9), overweight (25-29.9) and obese (>30). The mean BMI for the study sample was 26 (SD=5). The majority of males (52.1% , n=38) had a normal weight, whereas the majority of females were either overweight or obese (67.5%, n=56). Furthermore, the BMI has shown to have a significant association with the gender ($X^2= 15.236$, $df=3$, $p<0.05$). Figure 4.1 illustrates

the BMI categories in relation to the gender.

Participants were requested to indicate their type of diabetes mellitus. Figure 4.2 illustrates that the majority (91.7%, n=143) had diabetes mellitus of Type 2, while only 8.3% (n=13) had Type 1.

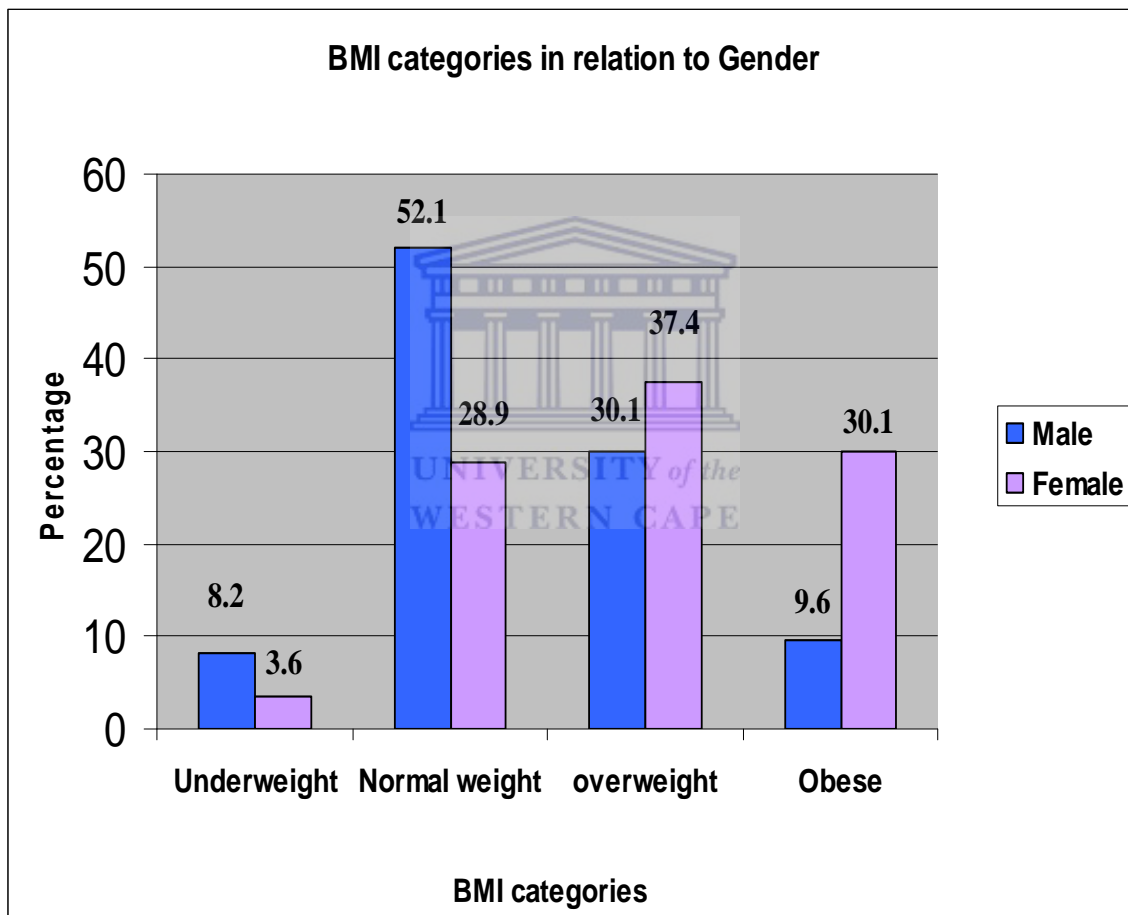


Figure 4.1 BMI categories in relation to the gender

Table 4.1 **Socio-demographic characteristics of the participants (n=156)**

Variable	Frequency	Percentage
Gender		
Male	73	46.8
Female	83	53.2
Marital status		
Single	27	17.3
Married	91	58.3
Separated	8	5.1
Widowed	30	19.2
Education levels		
Never went to school	22	14.1
Primary school	64	41.0
Secondary (1-3)	31	19.9
Secondary (4-6)	21	13.5
Tertiary education	18	11.5
Type of diabetes mellitus		
Type 1 diabetes	13	8.3
Type 2 diabetes	143	91.7



4.3. PERCEIVED HEALTH STATUS OF STUDY SAMPLE

Participants were asked to rate their health as being poor, fair, good or very good. Fig 4.3 illustrates that almost an equal percentage of participants reported to have a poor (30.1%, n=47), a fair (31.4%, n=49) and good health status (32.7%, n=51). Furthermore, participants that perceived their health status as very good had a lower mean age of 40.22 years (SD=15.579), compared to those that perceived their health status as poor (mean age= 51.02 years, SD= 15.82).

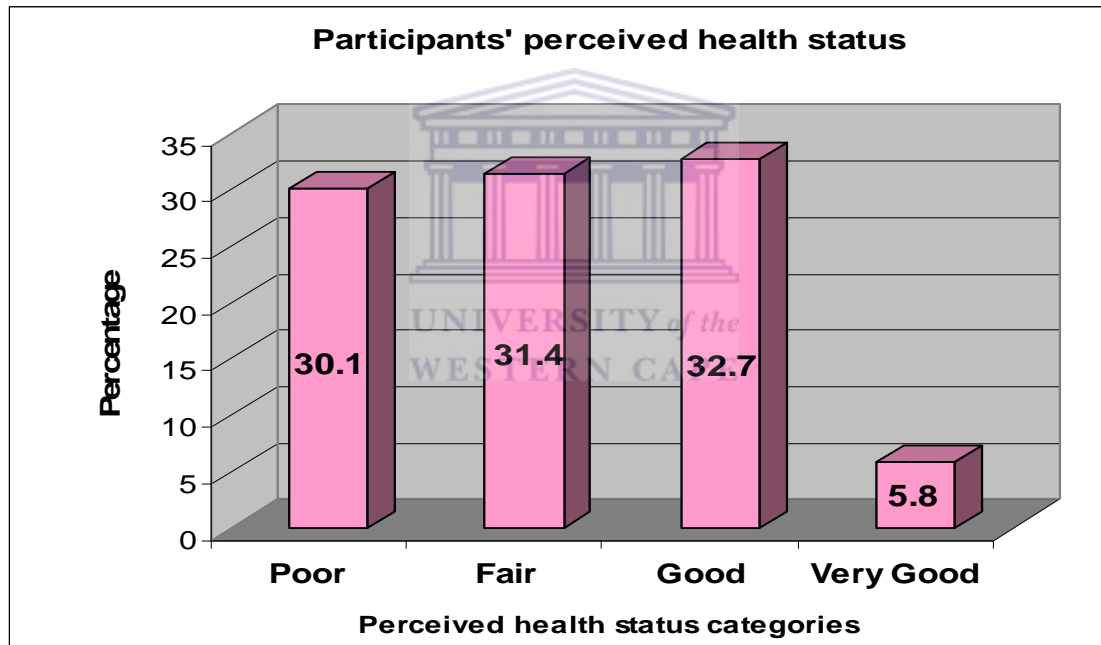


Figure 4.3 Participant's perceived health status

4.4 PARTICIPANTS' SELF- EFFICACY FOR DIABETES

Participants were requested to score their level of confidence in dealing with various activities of daily living with regards to diabetes mellitus. Each of the 8 questions was scored out of 10, giving a total rate of 80. The self-efficacy values were further

dichotomized into two categories: poor (<40) and good self-efficacy (>40). The biggest number of participants showed a good level of confidence in dealing with diabetes (80.8% , n=126) and had a lower mean age (47.1 years) compared to those with low self-efficacy (53.8years). Furthermore, the level of education was significantly associated with the self-efficacy categories ($X^2=11.093$, $df=3$, $p<0.05$). Table 4.2 illustrates the participants' self-efficacy categories in relation to various variables.

Table 4.2 Self-efficacy categories in relation to socio-demographic variables (n=156)

	Poor self-efficacy (<40)		Good self-efficacy (>40)	
Variables	Frequency	Percentage	Frequency	Percentage
Mean Age	53.8	SD= 16.2	47.1	SD=14.1
Gender				
Male	12	16.4	61	83.6
Female	18	21.7	65	78.3
Level of education*				
Never went to school	9	40.9	13	59.1
Primary school	14	21.9	50	78.1
Secondary school	6	11.5	46	88.5
Tertiary education	1	5.6	17	94.4
Marital status				
Single	4	14.8	23	85.2
Married	15	16.5	76	83.5
Separated	1	12.5	7	87.5
Widowed	10	33.3	20	66.7

Significant (p<0.05)*

4.5 LEVELS OF PARTICIPATION IN PHYSICAL ACTIVITY

Both the duration and the number of days/sessions were considered in the International Physical Activity questionnaire (IPAQ), and an overall total physical activity MET-minutes/week score were calculated. Three levels of physical activity –low, moderate and high were obtained taking into consideration the MET-minutes/week values obtained: Low (0-599 MET-minutes/week score), moderate (600-2999 MET-minutes/week score) and high (over 3000 MET-minutes-week score) (Craig et al., 2003).

The IPAQ assesses different types of PA, namely work-related, transportation-related, domestic and leisure time PA. Participants were requested to report on all of these activities performed for a duration of 10 minutes and more during the last 7 days. Table 4.3 illustrates that the majority of the sample were classified as having low levels of physical activity in all the different categories of PA. The table further illustrates that the lowest mean MET-minutes/week was obtained during leisure-time activities (233.37 MET-minutes/weeks) and the highest mean MET-minutes/week during work-related activities (685.78 MET-minutes/weeks). Moderate levels of activity were met by almost a third of the participants (31.4%, n=38) during physical activities related to transportation.

PA levels were further dichotomized into active versus inactive. Participants who accumulated less than 599 MET-minutes/week were considered inactive and those who accumulated 600 and more MET-minutes/week, as active (Craig et al., 2003). More than a third (39.7%, n=62) of the participants was categorized as inactive or sedentary as illustrated in figure 4.4.

Table 4.3 Levels of participation in physical activity (n=156)

PA categories	n	%	Mean MET-minutes/week score
Work PA			685.78
Low	123	78.8	
Moderate	12	12.8	
High	21	8.3	
Transportation PA			602.12
Low	107	68.6	
Moderate	38	31.4	
High	11	7.1	
Domestic& yard PA			575.38
Low	126	80.8	
Moderate	11	14.1	
High	19	5.1	
Leisure-time PA			223.37
Low	138	88.5	
Moderate	14	10.9	
High	4	0.6	



PA: Physical activity

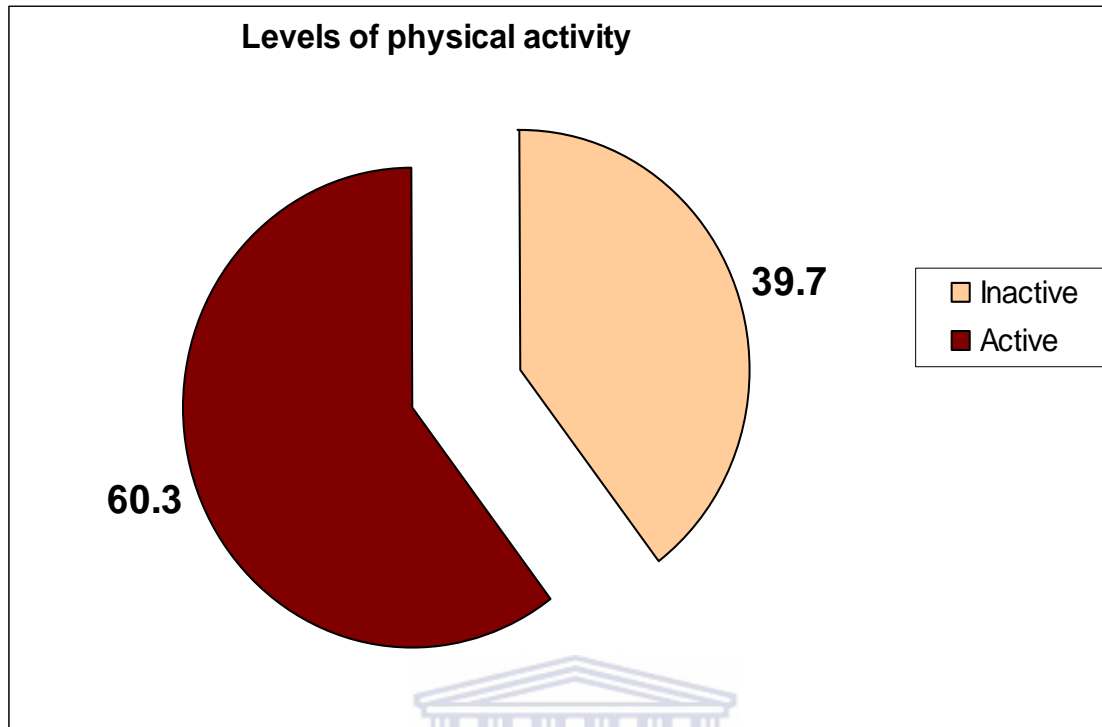


Figure 4.3 Physical activity levels of the study sample



4.6 FACTORS ASSOCIATED WITH PARTICIPATION IN PHYSICAL ACTIVITY

The association between different socio-demographic, health related factors and the levels of physical activity are summarized in table 4.4.

Table 4.4 Factors associated with participation in physical activity (n=156)

Variable	Sedentary (n=62)		Active (n=94)	
	Frequency	Percentage	Frequency	Percentage
Mean Age*	51.69		45.67	
Gender				
Male	30	48.4	43	45.7
Female	32	51.6	51	54.3
Marital status *				
Single	5	8.1	22	23.4
Married	42	67.7	49	52.1
Separated	1	1.6	7	7.5
Widowed	14	22.6	16	17
Education levels *				
Never went to school	16	25.8	6	6.4
Primary school	23	37.1	41	43.6
Secondary school (1-6)	9	14.5	43	45.7
Tertiary education	14	22.6	4	4.3
BMI				
Underweight	5	8.1	4	4.3
Normal weight	28	45.2	34	36.2
Overweight	16	25.8	37	39.4
Obese	13	20.9	19	20.1
Perceived health status				
Poor	25	40.3	22	23.4
Fair	19	30.7	30	31.9
Good	15	24.2	35	37.2
Very good	3	4.8	7	7.5
Self-efficacy for diabetes *				
Poor self-efficacy	18	29	12	12.8
Good self-efficacy	44	71	82	87.2

*Significant ($p < 0.05$)

4.6.1 Age

The association between participants' mean age and the patterns of physical activity indicated that participants categorized as active had a statistically significant lower mean age (45.67years) than those categorized as inactive (51.69years) ($p < 0.05$).

4.6.2 Gender

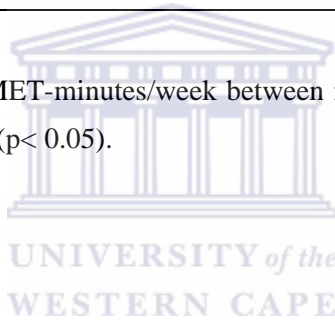
A higher prevalence of females (54.3%, $n=51$) than males (45.7%, $n=43$) were considered to be physically active. The association between gender and physical activity patterns was not significant ($p > 0.05$). In the respective PA categories, females showed the highest MET-minutes/week values during domestic-related PA, in contrary to the males whose highest MET-minutes/ week were during work-related PA. Furthermore, a student-t test was carried out to test the significance of the differences in mean MET-minutes/week between the categories of PA and various variables. The mean MET-minutes/week were found to be significantly greater for females in the domestic categories, whereas the leisure-time mean MET-minutes/week was significantly greater for males ($p < 0.05$). Table 4.4 illustrates the mean MET-minutes/week in relation to the gender.

Table 4.5 Mean MET-minutes/week by gender

PA categories	Gender	
	Males	Females
Work PA	916.9	402.5
Transportation PA	656.2	554.5
Domestic/yard PA *	127.5	969.2
Leisure-time PA *	300.1	155.8
Total PA	2000.7	2139.0

PA: Physical activity

*Significant difference in mean MET-minutes/week between males and females in the domestic and leisure-time categories of PA ($p < 0.05$).



4.6.3 Marital status

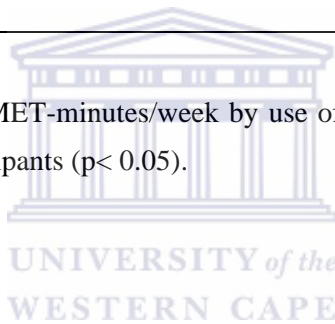
A significantly higher prevalence of participants that were married (52.1%, $n=49$) were considered physically active than those that were single (23.4%, $n=22$) and separated (7.5%, $n=7$) ($X^2=9.720$, $df=3$, $p < 0.05$). The respective mean MET-minutes/week in all the physical activity categories was examined in relation to the marital status. Married participants had the highest mean MET-minutes/week in the domestic category of physical activity as illustrated in Table 4.6. Results of the student-t test indicated the total PA mean MET-minutes/week was significantly greater for married individuals as compared to those who were single ($p < 0.05$).

Table 4.6 Mean MET-minutes/week by marital status

PA categories	Marital status			
	Single	Married	Separated	Widowed
Work PA	897.0	761.6	309.4	365.9
Transportation PA	847.2	517.2	759.0	597.3
Domestic/yard PA	318.5	1288.7	1245.0	534.0
Leisure-time PA	362.8	190.1	210.0	202.5
Total PA *	1787.4	3395.7	2523.4	1635.7

PA: Physical activity

*Significant difference in mean MET-minutes/week by use of the student-t test: in the total PA between married and single participants ($p < 0.05$).



4.6.4 Level of education

The levels of education was significantly associated with the patterns of physical activity ($X^2 = 32.229$, $df = 4$, $p < 0.05$). A significantly higher prevalence of participants having a secondary school level of education were found to be active (45.7%, $n = 43$), in comparison to those who reached the tertiary level of education (4.3%, $n = 4$). Table 4.7 illustrates the mean MET-minutes/week in relation to the level of education. Participants with a secondary level of education had the highest mean MET-minutes/week scores in the work-related (825.5 mean MET-minutes/week), transportation (739.0 mean MET-minutes/week) and leisure-time physical activity categories (336.5 mean MET-minutes/week). In the transportation PA categories, mean MET-minutes/week were

significantly greater for participants with either primary and secondary levels of education, compared to those in the tertiary level ($p < 0.05$). Similarly, the total PA mean MET-minutes/week was significantly greater for participants who with primary and secondary levels of education, compared to those in the tertiary level ($p < 0.05$).

Table 4.7 Mean MET-minutes/week by level of education

PA categories	Levels of education			
	No education	Primary level	Secondary level	Tertiary level
Work PA	516.8	777.7	825.5	161.8
Transportation PA*	408.0	654.1	739.0	259.0
Domestic/yard PA	592.7	712.9	538.0	173.3
Leisure-time PA	91.4	213.0	336.5	94.4
Total PA*	1608.9	2327.8	2439.0	688.6

PA: Physical activity

*Significant difference in mean MET-minutes/week by use of the student-t test:

In the transportation PA (primary education > tertiary level and secondary level > tertiary level)

In the total PA (primary education > tertiary level and secondary level > tertiary level) ($p < 0.05$)

4.6.5 Body Max Index (BMI)

A higher prevalence of participants who were classified as overweight (39.4%, $n=37$) and those with normal weight (36.2%, $n=34$) were considered physically active. The association between physical activity patterns and BMI was not statistically significant and there were no significant difference in the mean MET-minutes/week between various BMI categories in all the different PA categories ($p > 0.05$). However, participants

classified as overweight had the highest mean MET-minutes per week (2154.9 mean MET-minutes/weeks) in the total physical activity mean MET-minutes/week values as illustrated in Table 4.8.

Table 4.8 Mean MET-minutes/week in relation to BMI categories

PA categories	BMI categories			
	Underweight	Normal weight	Overweight	Obese
Work PA	204.0	706.3	580.2	956.3
Transportation PA	557.3	606.0	674.0	488.1
Domestic/yard PA	676.7	562.2	659.2	433.8
Leisure-time PA	331.1	200.1	277.7	148.1
Total PA	1769.1	2074.6	2154.9	2026.2

PA: Physical activity

4.6.6 Perceived health status

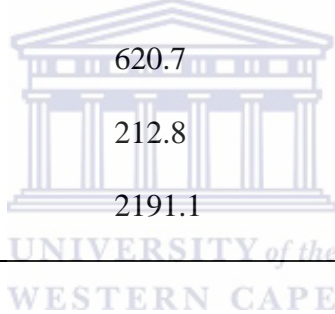
The majority of the participants (37.2%, n=36) who reported their health status as being good were found to be active, in contrary to those (40.3%, n=25) who perceived their health as poor who were classified as inactive. However, there is no statistic association of the participants' perceived health status and the patterns of physical activity and there is no significant difference in the mean MET-minutes/week between various perceived health status categories in all the different PA categories ($p>0.05$). The highest mean MET-minutes/week was observed for participants perceiving their health as good, in all

categories of physical activities, including the total mean MET-minutes/week value (2561.8 total mean MET-minutes/week) as illustrated in Table 4.9.

Table 4.9 Mean MET-minutes/week in relation to the participants' perceived health status

PA categories	Perceived health status			
	Poor	Fair	Good	V.Good
Work PA	478.1	812.2	828.2	275
Transportation PA	524.5	545.5	781.2	300.7
Domestic/yard PA	481.7	620.7	666.8	300
Leisure-time PA	175.9	212.8	285.6	176.7
Total PA	1619.4	2191.1	2561.8	1052.3

PA: Physical activity



4.6.7 Self-efficacy for diabetes mellitus

The majority of participants (87.2%, n=82) who showed good self-efficacy for diabetes was active. A statistically significant difference in the patterns of physical activity was observed between participants based on their self-efficacy for diabetes ($X^2=6.364$, $df=1$, $p<0.05$). Table 4.10 illustrates the mean MET-minutes/week in relation to the participants' self-efficacy for diabetes. Participants with good self-efficacy for diabetes had the highest mean MET-minutes/week in all categories of physical activities, including the total mean MET-minutes/week value (2296.0 total mean MET-

minutes/week). Furthermore, the mean MET-minutes/week were significantly greater for participants with good self-efficacy in work-related PA and in the total PA values ($p<0.05$).

Table 4.10 Mean MET-minutes/week in relation to self-efficacy categories

PA categories	Self-efficacy categories	
	Poor self-efficacy	Good self-efficacy
Work PA *	70.3	832.3
Transportation PA	423.5	644.6
Domestic/yard PA	507.0	591.7
Leisure-time PA	142.5	242.6
Total PA *	1143.3	2296.0

PA: Physical activity

*Significant difference in mean MET-minutes/week between the self-efficacy categories in the work and total PA categories ($p< 0.05$) by use of the student-t test.

4.7 BARRIERS TO PHYSICAL ACTIVITY PARTICIPATION

Barriers to physical activity participation were examined for the study sample. Figure 4.4 illustrates that the majority of participants (79.5%, $n=124$) encountered barriers to physical activity participation. Participants who reported that they have encountered barriers to physical activity participation were significantly more likely to be classified as inactive (98.4%) as illustrated in figure 4.5 ($X^2=27.606$, $df=2$, $p<0.05$).

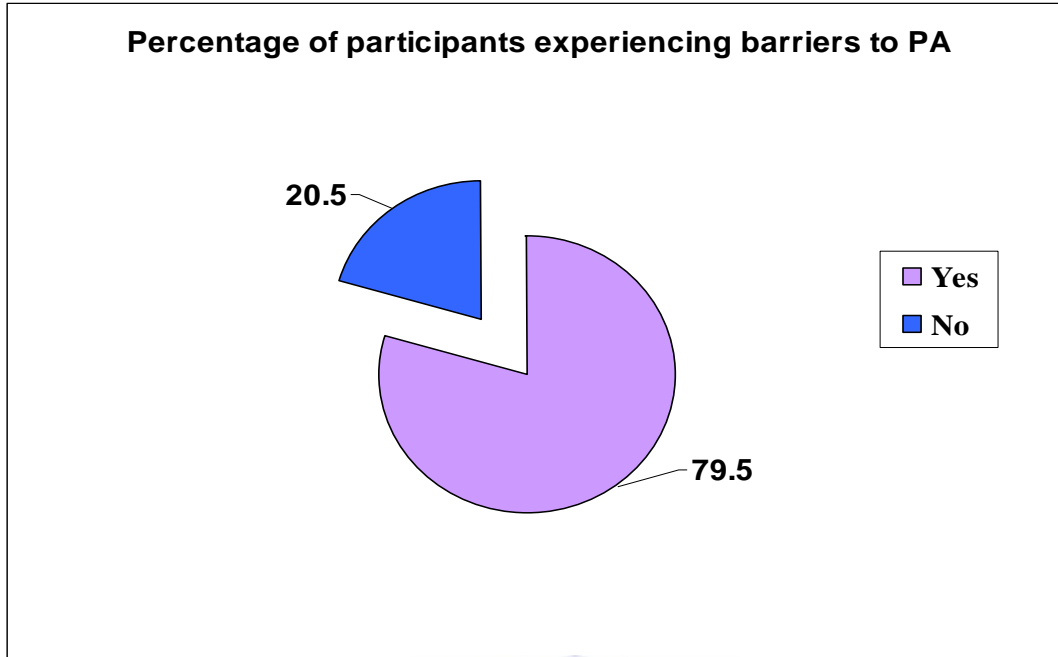


Figure 4.4 Percentage of participants experiencing barriers to participation in physical activity

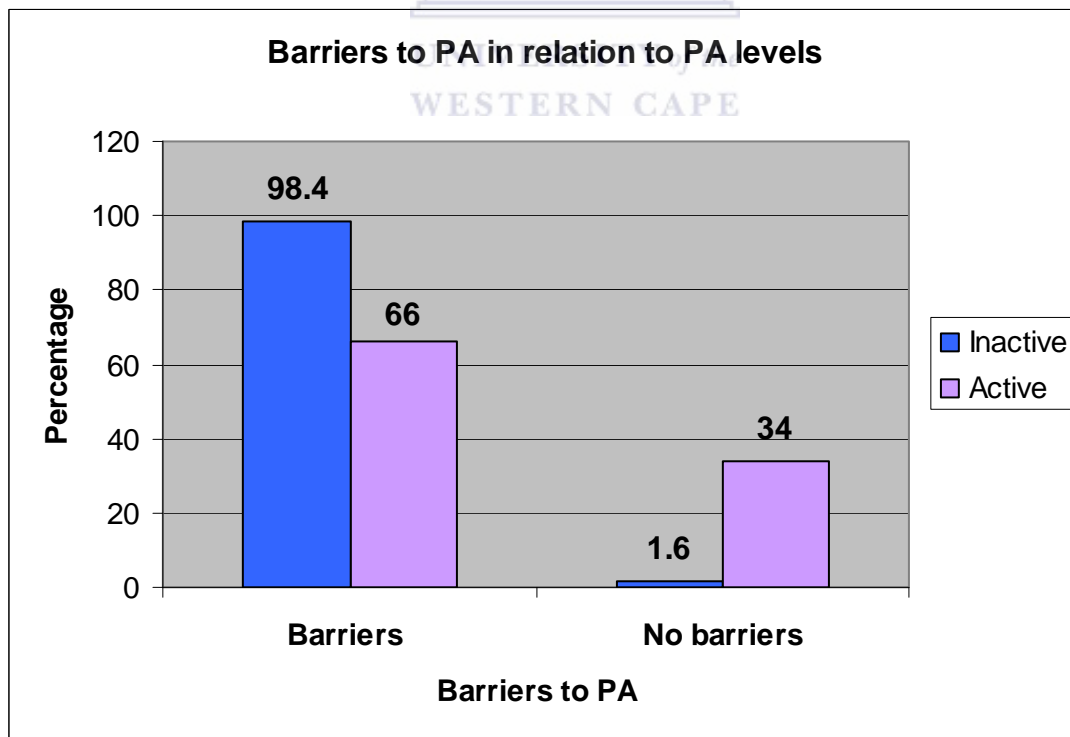


Figure 4.5 Barriers to PA in relation to the levels of PA

Participants were requested to report barriers that kept them from participating in physical activity. As shown in figure 4.6, the three most likely barriers to PA were having a poor health status (35.9%, n=56), the lack of motivation (28.8%, n=45) and the lack of awareness of the importance of PA (25%, n=39).

Among the other barriers stated, participants reported poverty with the challenges in getting their daily food and the lack of special guidance on the type and the amount of PA recommended for people with diabetes mellitus was also reported to be a barrier to the participation in PA.

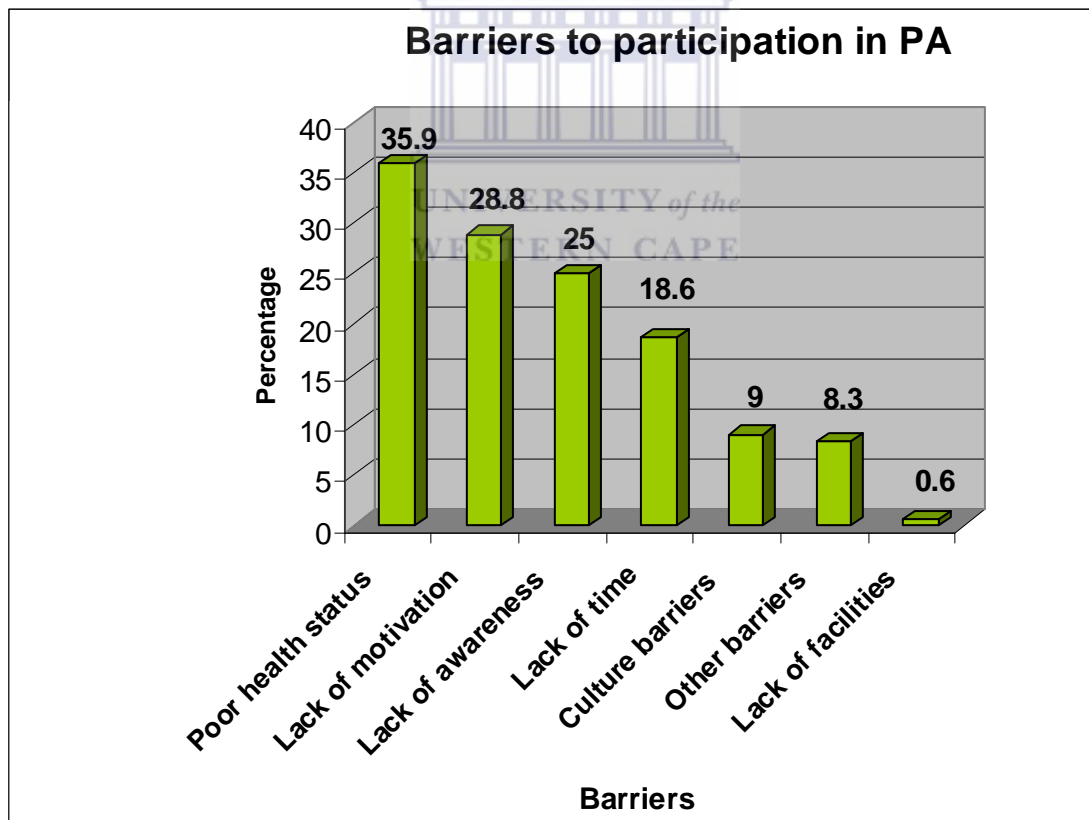


Figure 4.6 Barriers to participation in physical activity

4.8 SUMMARY

The current study aimed to establish the levels of physical activity and factors associated with it among adults with diabetes mellitus in Kigali, Rwanda. A significant number of individuals with diabetes were found to be physically inactive. Various factors that are associated with physical activity were highlighted. Due to the importance of physical activity in the management of diabetes, attention should be given to the factors influencing it. The next chapter will present an integrated discussion of the data outlined in this chapter.

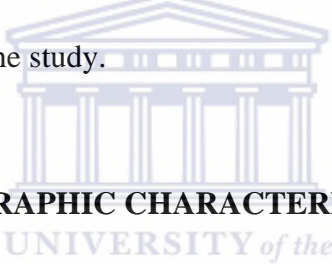


CHAPTER FIVE

DISCUSSION

5.1 INTRODUCTION

The aim of the study was to examine the factors that are associated with the levels of physical activity among adults with diabetes mellitus in Kigali, Rwanda. This chapter therefore discusses the results of the study in the context of the aim, and objectives of the study. Furthermore, the findings are analyzed and discussed in relation to previous similar studies or contextual data to give inferences. The chapter concludes by highlighting the limitations of the study.

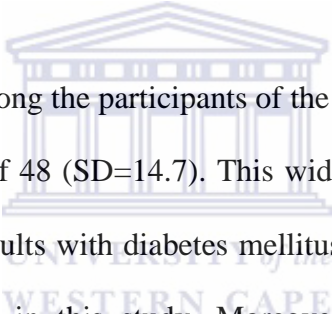


5.2 SELECTED DEMOGRAPHIC CHARACTERISTICS AND THEIR ASSOCIATION WITH DIABETES MELLITUS

Participants indicated a willingness and high interest in participating in the study and completing the questionnaire. This is a positive element which gives hope in the success of future interventions aiming at increasing and encouraging the participation in physical activity among adults with diabetes mellitus in Rwanda.

In the study sample, the prevalence of females was slightly higher (53.2%) compared to the males (46.2%). This could be explained by the fact that several studies have highlighted the increased predisposition of females to non-communicable diseases in general and diabetes mellitus in particular. Campaign and Wishner (2000) in their study

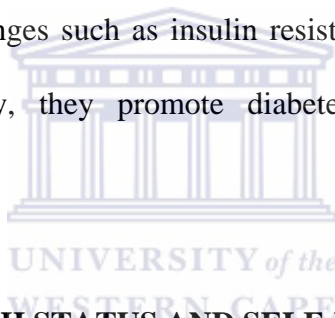
reviewed information related to women with diabetes mellitus. They stated that type 2 diabetes is more prevalent among women than men, making prevention and early detection particularly important in women. To the same opinion, Moore, Zgibor and Dasanayake (2003) later mentioned that the prevalence of diabetes in adults is slightly higher in women and increases significantly with age. Furthermore, in 2002, the Center for Disease Control and Prevention (Dishman, Washburn & Heath, 2003) estimated that in the U.S. population the prevalence of diabetes was about 9.8 million women and 6.9 million men. These data gives an indication of the increasing prevalence of diabetes among women in particular.



There was a wide age range among the participants of the study. The ages ranged from 18 to 83 years, with a mean age of 48 (SD=14.7). This wide standard deviation signified a wide deviation in the age of adults with diabetes mellitus, which meant that both young and old adults were included in this study. Moreover, as the majority (91.7%) of participants was of type 2 diabetes, this age range is indicative of a higher prevalence of adults diagnosed with diabetes mellitus at a younger age. This goes in accordance with the results of several studies which highlight the increasing prevalence of people who are affected with chronic diseases of lifestyle in general, and diabetes mellitus in particular at a younger age. Indeed prevalence studies have indicated that type two diabetes, which is strongly linked to obesity and physical activity, is now increasingly being found in young people and even diagnosed among adolescents (Gerberding, 2008).

Lastly, the findings on demographic characteristics in this study showed that more than

half of the participants (54.5%) were categorized as being either overweight or obese. Type 2 diabetes mellitus is known to be strongly associated with the body mass index (BMI). Furthermore, several studies have highlighted the increasing predisposition of getting type 2 diabetes among individuals who are either overweight or obese (Boutayeb & Boutayeb, 2005; Chatuverdi, 2007). Shahar (2008) stated that most people with type 2 and some with type 1 diabetes are in most cases overweight or obese. Similarly, a study by Chatuverdi (2007) reported that the growing prevalence of obesity is the major factor driving the increasing prevalence of type 2 diabetes. The association between type 2 diabetes and an increased BMI could be explained by the fact that overweight and obesity lead to adverse metabolic changes such as insulin resistance, increased blood pressure, and cholesterol; consequently, they promote diabetes and cardiovascular disease (Boutayeb & Boutayeb, 2005).



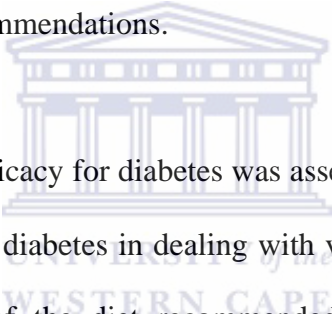
5.3 PERCEIVED HEALTH STATUS AND SELF-EFFICACY FOR DIABETES

According to the Center for Disease Control and Prevention (CDC, 2006), self-rated health status is a useful indicator of a population's overall well-being because lower ratings of health status have been associated with increased mortality and morbidity. They added that fair or poor health among persons with diabetes is also associated with the possible presence of diabetes-related complications. Furthermore, the CDC indicated that the findings that adults with diabetes are more than three times more likely to report fair or poor health reflects the effect of diabetes and its complications on quality of life (CDC, 2006). This is highlighted in the current study which indicated that almost an equal number of participants rated their health as being poor (30.1%), fair (31.4%) and

good (32.7). Indeed, these results indicate that close to one third of the participants rated their health as being poor. Numerous studies have reported self-rated fair or poor health to correlate with certain health factors such as obesity, illness severity, duration of diabetes and certain socio-demographic characteristics such as low level of education (CDC, 2006). More to that, poverty, with the difficulty to access drugs and follow an adequate diet plan as requested for individuals with diabetes can also impact on the diabetic' people perceived health status. This is even more challenging for people with type 1 diabetes who need insulin on a daily basis for their survival. This is highlighted by Gishoma (2005) who indicated that in Rwanda, the widespread poverty of the population represents a major risk to health. He added that the excessive cost of insulin and diabetes supplies to people with the condition remains a major threat to the health of most people with diabetes in the country. Moreover, difficulty to afford the cost of an adequate follow up and blood glucose tests can also impact on the health as well as the psychological status of individuals with diabetes. This is particularly true in Rwanda, where the pharmacies themselves often lack necessary diabetes supplies, such as strips to test levels of glucose which is essential in the management of the condition, due to the difficulties with the distribution, storage, and transportation of medical supplies (Gishoma, 2005).

Diabetes is a chronic disease which requires a daily and complete involvement of those affected in the control of control of their blood glucose, through adequate diet, regular physical activity and a strict compliance with the drug medication when needed to avoid diabetes-related morbidity and mortality. Self-efficacy is a cornerstone of diabetes care, which contributes to the improvement of individuals' self-management, thus improving

their quality of life (Sarkar, Fisher & Schillinger, 2006). Moreover, research has shown that self-efficacy in dealing with diabetes result in sustained blood glucose control and reduces comorbidities associated with diabetes (Stys & Kulkarni, 2007). This seems consistent with the findings of a study by Grey, Boland, Yu, Sullivan-Bolyai, and Tamborlane (1998), who showed that adolescents who had higher diabetes self-efficacy coped more successfully with their diabetes, were more satisfied with their quality of life, and had lower levels of depression. Similarly, in the study by Aljaseem, Peyrot and Rubbin (2001) greater self-efficacy also positively impacted on individual's health in that it resulted in more frequent blood glucose testing, less skipping of medication and closer adherence to management recommendations.



In the current study, the self efficacy for diabetes was assessed to measure the confidence and ability of participants with diabetes in dealing with various aspect of their everyday life such as the knowledge of the diet recommended for diabetes, the signs of a hypoglycaemic event, and how to deal with it. The majority of participants showed a good self-efficacy for diabetes and this could be is indicative of the involvement of the RDA clinic in educating their patients on how to deal with their everyday lives. Once per month, the RDA organizes a meeting with individuals with diabetes, whereby various topics in relation to diabetes are discussed. However, despite the fact that all people with diabetes coming for their management and follow up at the RDA clinic are strongly advised to attend those meetings, the attendance rate remains very low. Efforts should be made in encouraging individuals with diabetes to attend those education sessions, and raise their awareness on the importance of dealing efficiently with diabetes in all aspects

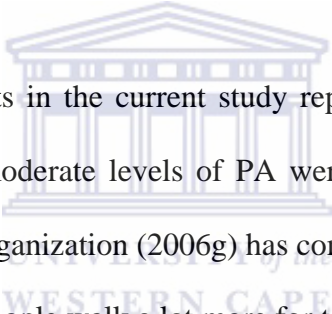
of their daily lives.

5.4 PHYSICAL ACTIVITY PARTICIPATION OF STUDY SAMPLE

Several studies have pointed out that although physical activity is considered to be a cornerstone in the management of diabetes, it remains by far the most underused (Colberg, 2008; Stys and Kulkarni, 2007). The findings of the current study support this in that more than a third of all the participants (39.7%) were categorized as inactive or sedentary. The findings of this study therefore concur with a similar study conducted in the United States to assess the PA levels among adults with diabetes, in which 44% of participants were classified as inactive (Morrato, Hill, Wyatt, Ghushchyan, & Sullivan, 2007). Moreover, Deshpante et al. (2005) also indicated in their study conducted in the United States, that slightly more than a third of participants with diabetes (37.2%) were classified as inactive. A possible reason for this inactivity could be explained by Kolt and Snyder-Mackler (2003) who stated that patients with chronic illnesses in general and diabetes mellitus in particular often avoid physical activity for fear of making their condition worse, or precipitate a hypoglycemic event. This highlight the need for appropriate education of individuals with diabetes on physical activity recommendations, health benefits and precautions so as to equip them with sufficient knowledge and skills to increase their confidence and motivation in integrating physical activities in their daily lives.

As highlighted in the literature review, all levels and areas of physical activity, including work-related, transportation-related, domestic-related and leisure-time activities can be

performed and are beneficial for people with diabetes mellitus (American Diabetes Association, 2003b). The results of the current study have however shown that the majority of participants had low levels of PA in all the different categories i.e. work, transportation, domestic and leisure-time related physical activities. These findings are similar to those of a study carried out in the US that indicated that the levels of PA reported by the participants were significantly low for the various categories of PA (Morrato et al., 2007). The authors further emphasized the great need for interventions programs to educate people with diabetes mellitus on the importance of including physical activity in the management on their condition.



The majority of the participants in the current study reported low levels of PA during leisure-time activities, while moderate levels of PA were found in activities related to transport. The World Health Organization (2006g) has come to the realisation that in poor and middle-income countries people walk a lot more for transportation than industrialised ones, and this has led to increased attention to walking and how to improve the quality of that activity. A considerable number of the Rwandan population, like many other African populations, face the multiple challenges caused by poverty. One of it being the difficulty to afford the cost of public transportation. Although this constitutes a burden, especially for individual with diabetes who may sometimes have to walk long distances, this may be view as beneficial in increasing the physical activity levels, not as a result of a conscious effort, but as a lack of choice due to poverty. On the other hand, leisure-time physical activities could be perceived by the participants as a luxury which can only be afforded by high-income individuals. This notion further illustrates the need and importance of

education and specific guidance of individuals with diabetes on the various types and intensity of physical activities which could be included in their daily lives.

5.5 FACTORS ASSOCIATED WITH PARTICIPATION IN PHYSICAL ACTIVITY AMONG ADULTS WITH DIABETES MELLITUS

5.5.1 Age

Various studies have consistently reported a decline in physical activity with advancing age (Sawatzky & Naimark, 2002; Blair & Church, 2003). The findings of the current study showed that more than a third of participants were categorized as inactive and had a significantly higher mean age of 51.7 years, compared to those active, whose mean age was 45.7 years. This could be explained by the fact that young people are more likely to engage in a physical activity compared to older ones, even in the general population. A study by Dishman et al. (2003) revealed that the overall participation in physical activity significantly decreases with increasing age.

Furthermore, with regards to diabetes, Thomas, Alder and Leese (2005) also indicated in their study that inactivity was most commonly seen in older patients and was often associated with the lack of self-efficacy, poor health status and feeling of tiredness. This also relates to the findings by CDC (2006) which indicated that in 2005, the age-specific prevalence of individuals rating their health as fair or poor was significantly lower among persons aged 18-44 years than among those aged 45-64 years or older than 75 years. This could be explained by the fact that increasing age is often associated with a greater

predisposition to morbidities and complications related to diabetes as a consequence of ageing, and poor adherence to healthy lifestyles.

5.5.2 Gender

Scientific evidence shows that men have higher rates of participation in leisure-time physical activities than women (Eyler et al., 2002; Barret, Plotnikoff, Cournaya & Raine, 2007). This evidence concur with the findings of the present study which indicated that the mean MET-minutes/week were significantly greater for males than females in the leisure-time PA category. In addition, the mean MET-minutes/week was found to be significantly greater for females in the domestic PA category than males. Culturally, Rwandese women were always considered to be the ones responsible for all household duties and caregiving activities. The involvement of men in the domestic activities was very low, and even though a trend towards women emancipation and gender equality is on the rise, these activities are still considered as women's duties. Furthermore, an increasing number of females are currently full-time or part-time workers. Meeting the double responsibility of household duties and daily work load could possibly limit and render it difficult for women to get the availability and time needed to engage in any kind of leisure-time physical activity in comparison with men. Moreover, Rwandese women from rural areas face the triple responsibility of family agriculture, household activities and children's caregiving. All these could explain the highest mean MET-minutes/week values which were shown by women in the domestic PA, in contrary to those of the leisure-time PA.

5.5.3 Marital status

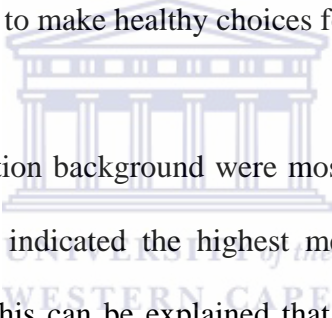
The marital status is an important determinant for physical activity participation (Pettee et al., 2006). The findings of their study indicated that when compared to their single counterparts, married men and women reported higher levels of physical activity. This goes in accordance with the findings of the present study which revealed that the majority of participants who were active were married (52.1%). This is surprising as single individuals with diabetes face less life responsibilities, family expenses and constraints as compared to those who are married. However, these findings are contrary to those of Eyler et al. (2002) which has shown that being married was negatively related to physical activity or exercise in a group of women.



5.5.4 Level of education

Several researchers are of the opinion that the higher the level of education and income are, the lower the physical activity level is (Sávio, Da Costa, Schmitz & Da Silva, 2008; Orsini, Bellico, Bottai, Pagaro & Wolk, 2007). This goes in accordance with the findings of the current study which indicated that the biggest number of participants who were classified as active had either a primary or a secondary school level of education, in contrary to those who reached the tertiary level of education who were mainly inactive. Furthermore, the mean MET-minutes/week was found to be significantly greater for individuals with primary and secondary levels of education compared to those of individuals with tertiary level of education. These findings suggest that the level of education is inversely proportional to the patterns and the levels of physical activity. This could be explained that people with low level of education are more likely to have

heavier or more physically demanding jobs in contrary to those with high education who tend to have lighter or more sedentary jobs. However, this is contrary to the study by Morrato et al. (2007) which indicated that physical activity was higher among diabetic participants who had higher level of education. This study suggested that those who are more educated have greater and easier access to information and knowledge, and therefore are more likely to follow the recommendations for the adoption of a regular physical activity. In addition, the study indicated that those more educated are generally those with higher income as compared to those without education. Being free from financial burden may facilitate the adoption of a healthy lifestyle like including regular physical activity and being able to make healthy choices for their diet.



Participants who had no education background were most likely to engage in domestic-related physical activities and indicated the highest mean MET-minutes/week values compared to other activities. This can be explained that in Rwanda, those who did not attend school rely on agriculture, farming and house-keeping activities for their living. Moreover, most of the families in the rural areas in Rwanda hire the services of people from rural areas for their house-keeping duties such as cooking, babysitting, house cleaning or gardening as most family members are workers.

The mean MET-minutes/week for transportation-related PA of individuals with primary and secondary levels of education was found to be significantly higher than those of individuals who reached the tertiary level of education. This is in accordance with the opinion of the WHO (2006g) that utilitarian PA (such as transportation-related PA and

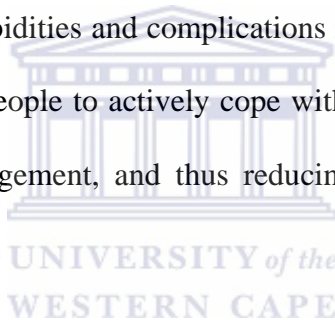
domestic PA) are highly prevalent among the vast majority of the lower income and least educated population. Currently educational qualification determines the earned income and work position. Therefore, people with lower levels of education often face the challenges of poverty, with the difficulty to afford the cost of public transport. This could explain their highest mean MET-min/week values in the transportation category.

Participants with tertiary level of education demonstrated their least mean MET-minutes/week values in their leisure-time activities. This is contrary to the WHO (2006g) which reported that recreational activities, like the practice of sports or exercise during leisure-time, are the most common form of physical activities among the higher income and education brackets. Therefore, given the fact that individuals with higher levels of education (tertiary level) were found to be mainly sedentary, with the lowest mean MET-minutes/week for all the PA categories, they may be considered as an at-risk group for complications and morbidities-related to diabetes mellitus. Therefore, there is an urgent need for implementing awareness education programs on the benefits of regular physical activity and exercise for individuals with diabetes, in particular those with higher education levels as they are the most likely to be adopt a sedentary lifestyle.

5.5.5 Self-efficacy for diabetes

The theory of self-efficacy proposes that patients' confidence in their ability to perform health behaviors influences which behaviors they will engage in (Sarkar et al., 2006). The authors further explained that because diabetes self-management incorporates behavioral, personal, and environmental factors into daily performance of recommended activities,

the concept of self-efficacy is relevant for improving self-management and integrating physical activity in daily lives. The findings of the present study indicated that the majority of participants (87.2%) who showed a good self-efficacy for diabetes were classified as active. Furthermore, participants with good self efficacy had a significantly greater mean MET-minutes/week in both work PA categories and in their total PA mean values. This also relates to the findings by Sarkar et al. (2006) which indicates that the self-efficacy for diabetes was significantly associated with improved diet and physical activity compliance, regular self-monitoring of blood glucose and effective foot care. This in turn, could possibly lead to the improvement of diabetic individuals' quality of life, with the reduction of morbidities and complications related to diabetes. Education is therefore crucial to motivate people to actively cope with their condition, enhancing the likelihood of successful management, and thus reducing healthcare costs incurred by treating diabetes complications.



5.6 BARRIERS TO PARTICIPATION IN PHYSICAL ACTIVITY

Physical activity is an important modality in the management of diabetes, through its reduction of morbidity and complications and improvement of diabetic individuals' quality of life. Tumusiime and Frantz (2006) highlighted the fact that a person's perceived barriers to physical activity are an important determinant of how active he or she becomes. The findings of the present study indicated that the majority of participants (79.5%) encountered barriers to participation in physical activity participation. These findings are similar to those of a study carried out in Canada, which indicated that 63.7% of participants with diabetes reported to have encountered barriers to perform a physical

activity (Plotnikoff et al., 2006).

Furthermore, the findings of the current study indicated that the common barriers encountered by the participants were: having a poor health status (35.9%), the lack of motivation (28.8%) and the lack of awareness of the importance of PA (25%). This concurs with the findings of a study by Shahar (2008), which indicated that people with diabetes face barriers to becoming active and such barriers often include the lack of motivation, a poor health status in the presence of diabetes-related complications and fatigue, but also depression and fear of hyperglycemia or hypoglycaemia. However, a study conducted by Thomas et al. (2005) among young and old adults with diabetes indicated that fear of diabetes getting worse, lack of motivation, depression and lack of time were the most important barriers to physical activity in young adults with diabetes, while the lack of self-efficacy, feeling of tiredness, poor health status and lack of specific guidance were barriers encountered by older ones. Following Thomas et al. (2005), Dutton, Johnson, Whitehead, Boderlos and Brantley (2005) conducted a study among people with diabetes and highlighted the common barriers to physical activity participation. These barriers include the lack of motivation, health problems, lack of social support, low self-efficacy for diabetes and lack of specific guidance.

The lack of motivation and poor health status therefore appear to be the common barriers encountered by individuals with diabetes. This highlights the great need for continuous support and encouragement of individuals with diabetes for the integration of physical activity in their daily routine, therefore increasing their motivation. Furthermore, the

health status of individual with diabetes is strongly related to the self-efficacy for diabetes, as diabetes is a chronic condition which requires daily adjustments and an individual's commitment in the fulfillment of these recommendations. This emphasizes once again the role of education both in promoting physical activity and equipping individuals with diabetes with skills and knowledge for better self-care and adherence to management recommendations.

The least likely barriers to physical activity considered by the adults with diabetes, which were included among the "other" factors were poverty, and the lack of specific guidance on the type and intensity of physical activity that could be beneficial for them. The lack of specific guidance has been shown to impact on diabetes people's participation in physical activity. In his study, Colberg (2008) indicated that positive changes in PA levels were greater for patients who were given a precise physical activity prescription that included a detailed regime on the type and intensity of recommended PA. Similarly, Steward (2004) indicated that although many individuals lose their motivation to participate in a physical activity, a lack of clear and specific guidelines from health care professionals is also an important factor contributing to its underuse. These findings therefore emphasize the great role of clinicians in general and physiotherapists in particular, in providing clear and specific guidance with relation to the PA levels, type and intensity for individuals with diabetes.

5.6 LIMITATIONS AND STRENGTH OF THE STUDY

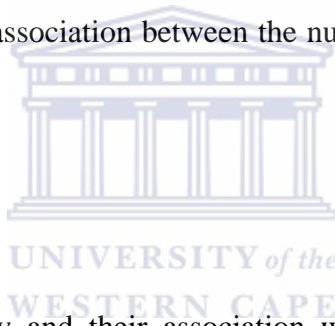
The results of the study should be interpreted in the light of the following limitations:

- The data obtained were self-reported, thus vulnerable to misrepresentation in simplifying or exaggerating them. Recall bias may also represent sources of error.
- Cross-sectional data may consistently describe patterns of association but not causality. A patient not participating in physical activity will not necessarily continue to do so. Thus caution should be employed when interpreting the results of a cross-sectional study when longitudinal data is not present.
- One of the limitations is that the data were collected during the least busy month at the RDA diabetic specialised clinic, and this has impacted on the obtained sample size. As explained by the clinic staff, this may be due to the fact that all the secondary and tertiary institutions start in January, with all the costs and expenses of the school fees and stationeries. Therefore, for those who already experience difficulties to come for their follow-up and blood tests, this may add on their limitations to attend the clinic.
- The blood glucose level values were not recorded on the questionnaire; this may have been of greater importance in getting a mean value for the participants' levels of blood glucose, thus giving an idea of their compliance in following the recommended aspects of their management. Moreover, patients were sent by the medical doctor, considering the exclusion criteria and the sampling technique. However, biases may have occurred on the doctor's side in the way of selecting participants to be sent for participating in the study. Getting a second person involved in the selection of participants could have minimized the risk of getting

bias or errors in considering the exclusion criteria and sampling technique.

Despite the limitations, the study had the following strengths:

- The study used a questionnaire which was adapted from validated and reliable studies, to adequately measure the levels of physical activity and determine the factors associated with those levels with respect to the validity and reliability issues.
- A systematic random sampling was used in the participants' selection, thus giving an equal chance to all participants and limiting biases. In addition, the analysis closely considered the association between the numerous variables and the levels of physical activity.



5.7 SUMMARY

The levels of physical activity and their association with various socio-demographic characteristics are thoroughly discussed in relation to previous similar studies. The barriers to participation in a physical activity are also discussed. Through the discussion, the important role of education for the promotion of physical activity is highlighted. The next chapter concludes the present study by presenting both summary and recommendations.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.4 INTRODUCTION

This chapter provides a summary and conclusion of the study. The fundamental findings are highlighted and finally, recommendations made from the study are provided at the end of this chapter

6.5 SUMMARY AND CONCLUSION

The aim of this study was to examine the factors that are associated with the levels of physical activity among adults with diabetes mellitus in Kigali, Rwanda. To achieve this, the levels of participation in physical activity were measured, and various factors associated to those levels were identified.

Literature has emphasized on the increasing prevalence of diabetes mellitus both in developed and developing countries. Moreover, it has indicated that prevalence rates are significantly rising among young and productive populations in the developing countries. The rapid urbanization with the adoption of western lifestyle in Africa in general and Rwanda in particular is considered to play a key role in the rise of diabetes. Physical activity is considered as a cornerstone in the management of diabetes, for its beneficial benefits. However, literature has demonstrated that physical activity remains the least used modality in people with diabetes daily lives. The motivation of this study was to assess the levels of physical activity among adults with diabetes mellitus and to identify

the factors associated with it and the possible barriers to physical activity. The information collected were hoped to provide a useful tool in the implementation of physical activity promotion strategies aiming at the prevention and appropriate management of people with diabetes, but also for those at risk of developing diabetes.

The Rwanda Diabetic Association specialized clinic was chosen as a research setting. A descriptive quantitative study was then carried out to describe the levels of physical activity participation and their association with the socio-demographic and health related factors among adults with diabetes mellitus. A cross sectional study was then used to collect information during a six weeks period of time. One hundred and fifty six (156) individuals with diabetes were randomly selected considering the exclusion criteria, and were willing to participate in the study. A self-administered questionnaire consisting of close-ended questions was used to collect the desired information. The questionnaire was adapted from three valid and reliable questionnaires and a pilot study was conducted to further ensure its validity and reliability. Data was then analyzed by use of both descriptive and inferential statistics. Descriptive statistics were used to summarize the levels of physical activity as well as the socio-demographic and health factors, while inferential statistics were used to test the association between these factors and the levels of PA.

Participants' age ranged from 18 to 83 years, with the mean age for both gender being 48 years. The females constituted slightly more than half of the participants (53.2%), and type 2 diabetes mellitus was by far the most prevalent (91.7%). With regards to the

marital status and the level of education, the majority of participants (58.5%) was married and had a primary school level education (41%). The participants' BMI was then calculated after recording their weights and heights, and the findings of the study revealed that more than half (54.5%) of the participants were either overweight or obese. Almost an equal number of participants perceived their health as poor, fair and good (30.1%, 31.4%, and 32.7% respectively). The self-efficacy for diabetes was rated by the participants and the majority of them (80.8%) showed a good level of confidence in dealing with diabetes in their daily lives.

The International Physical Activity Questionnaire was used to assess the levels of PA in four different categories namely work-related, transportation-related, domestic-related and leisure-time related physical activities. The results of the study showed that the majority of participants were having low levels of PA in all the different categories. Furthermore, more than a third of all the participants (39.7%) were categorized as inactive or sedentary.

The following factors were found to be significantly associated with the levels of PA: marital status, level of education, body mass index and self-efficacy for diabetes. Significant differences in the mean MET-minutes/week were found between the gender, marital status, level of education and self-efficacy categories.

The majority of participants (79.5%) indicated that they had encountered barriers to physical activity. Furthermore, those who responded that they have encountered barriers

to PA participation were significantly more likely to be classified as inactive as those reporting no barriers to PA. Common barriers to PA as reported by the participants were the lack of awareness of the importance of PA (25%), a poor health status (35.9%) and the lack of motivation (28.8%).

The aim and objectives of this study were achieved and the findings indicated that most participants were inactive. These findings are in accordance with similar studies done in various countries. The participants' spontaneous willingness to participate in the study gives hope in the future success of an intervention program to raise diabetic individuals' level of awareness on the benefits on PA, and increase their PA levels. In addition, the numerous questions asked by the participants in relation to the recommended types and intensity of PA for their health benefits is also indicative of their curiosity and willingness to improve their PA levels and improve their health.

6.6 RECOMMENDATIONS

- It has been widely documented that physical activity plays a key role both in the management and prevention of diabetes mellitus. There is a great need therefore for the Rwanda Diabetic Association to work at raising awareness among diabetics on the need to include PA in their daily lives, therefore eliminating two of the most common reported barriers namely “lack of awareness” and “lack of motivation”. A physiotherapy department should be of great importance to the clinic, not only for rehabilitation after complications, but also for advice on the

type and intensity of PA required by individuals with diabetes, with regards to their individual needs, and health status.

- Once per month, the Rwanda Diabetic Association organizes a meeting whereby different topics in relation to diabetes are discussed such as diet, drug therapy or physical activity. However, few individuals with diabetes attend these meetings. Radio is considered as the most popular means of information, therefore, radio emissions regarding diabetes would be beneficial for the prevention of diabetes for those at risk and for increasing diabetic people's awareness on the importance of integrating PA in their routine lives.
- Peer motivation specifically by family members and friends who share the same challenges in dealing with diabetes would be a major factor in promoting healthy lifestyles through the promotion of physical activity, diet, and other key factors. Therefore, support groups within the communities would be of great benefits for people with diabetes, in organizing physical activities among themselves, but also in sharing and discussing the challenges that they are facing and the means of overcoming them.
- The role of physiotherapists in promoting the health of people with diabetes through the advocacy of physical activity should be emphasized to the physiotherapists and to other members of the medical team. This will increase other medical staff members' awareness on the benefits of referring patients diagnosed with diabetes for advices on PA, but also those at risk including some with impaired fasting glucose, impaired glucose tolerance or obesity.

- Healthy lifestyles have been strongly associated with the prevention of non-communicable diseases in general and diabetes mellitus in particular. It is therefore important that health education programs be implemented in schools from primary to tertiary education so as to promote the benefits of adopting healthy lifestyles at a young age. The Ministry of education should render this recommendation possible by establishing a policy that would promote healthy behaviours and physical activity in schools and higher institutions. In addition, the Ministry of health should emphasize the need for healthy behaviours among the general population as a preventive measure for non-communicable diseases in general and diabetes mellitus in particular. It should advocate for the need to integrate programmes of physical activity in work, school and other various common settings.
- The accessibility of drugs for diabetics is a key element for their health. In addition, it would have an impact on their confidence in increasing their physical activity patterns. This, because physical activity is more likely to be performed by individuals with diabetes who can access the prescribed recommended dosage and types of medication which are essential for the control of their blood glucose. The Ministry of health should play a key role in establishing means that would help with the accessibility and affordability of essential medication for people with diabetes, especially those with type 1 diabetes who needs daily insulin dosages for their survival.

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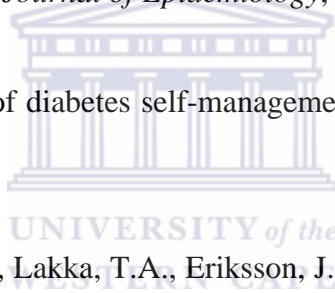
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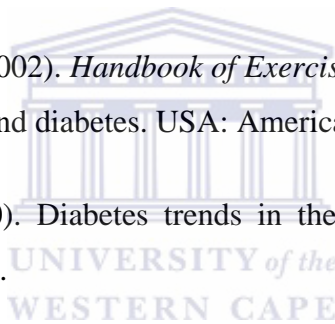
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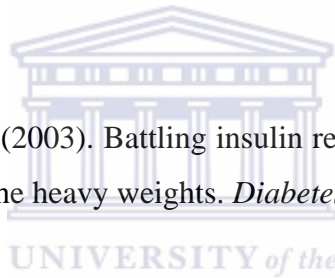
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