SELF-CARE PRACTICES AND PSYCHOSOCIAL DISTRESS FOR PEOPLE WITH TYPE 2 DIABETES MELLITUS IN DAR ES SALAAM, TANZANIA

BY

RASHIDI HERI

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ABSTRACT

Nutritional intake and modification of lifestyle are the cornerstones for management of Type 2 diabetes. It has been recognized that, in order to achieve satisfactory metabolic control, adoption of self-care skills by the diabetic person is crucial. The aim of this study was to determine self-care practices and diabetes related emotional distress for people with Type 2 diabetes mellitus in Dar es Salaam, Tanzania. A cross sectional survey involving 121 people with Types 2 diabetes was conducted in four diabetic clinics located in Dar es Salaam. Both descriptive and inferential statistical analyses were carried out using Statistical Package for Social Sciences (SPSS 11.5). Result of the study showed that, the level of self-care practices in area of diet, physical exercises, medication, and blood glucose test was not up to desired level of practice requiring following of all of the recommendations in seven days per week without missing. Diabetic related emotion distress for studied sample was low and comparable to levels reported in other studies however the level was not in line with the score recommended in PAID. The recommended PAID score for emotion is zero. For this reason, efforts are needed to reduce the emotional stress among diabetic subjects. The main problem in self-care was financial limitation and lack of care education. Efforts are therefore required to improve the quality of care including self-care education, counselling and medical support. Following the result of this study it is recommended that, the government and other stakeholders should increase effort to lower the cost of diabetic services like diabetic tests and medications; Given the importance of self monitoring of blood glucose to diabetes care, government, and other stakeholders should strive to make the procedure readily accessible and affordable for all patients who require; Further research is needed to determine optimum self-care practices and diabetic related emotional distress levels that can predict good glycemic control that would help researcher and programme managers to be able to monitor the progress of diabetic care programs.

DECLARATION

I, Rashidi Heri do hereby declare to the Senate of Sokoine University of Agriculture that the work presented here is my own work and has not been submitted for any degree award in any other University.

Rashidi Heri (MSc. Candidate)	Date

The above declaration is confirmed

Prof. T. C. E. Mosha (Supervisor)	Date

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DEDICATION

This work is dedicated to my parents, Mr Heri Kiangi and Mrs Ezena Mohamed for their excellent parenthood and continuous support throughout my study period.

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A linear multiple regression model was built to check the predictors of glycemic control into which fasting blood glucose was taken as a dependent variable. Categorical variables such as marital status, level of education, perceived income, occupation and gender was changed to dummy variables before used to the model. The model was significant ($p = 0.001$) and was able to explain 33.6% of the variation in the fasting blood glucose (Table 11). Younger age, lower BMI, increased duration of

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LIST OF ABREVIATIONS

ADA	American Diabetic Association
BG	Blood Glucose
BMI	Body Mass Index
BP	Blood Pressure
CHD	Coronary Heart Disease
CVD	Cardiovascular Disease
DAN	Diabetic Autonomic Neuropathy
DAWN	Diabetes Attitudes, Wishes, and Needs
DCCT	Diabetes Control and Complications Trial
DM	Diabetes Mellitus
DPN	Distal Symmetric Polyneuropathy
DSME	Diabetes Self-Management Education
FBG	Fasting Blood Glucose
HDL	high-density lipoprotein cholesterol
IGF	Insulin like Growth Factor
IRS	Insulin Receptor Substrate
LDL	Low Density Lipoproteins
MI	Myocardial Infarction
MOH	Ministry of Health
MUAC	Mid-upper Arm Circumference
MUCHS	Muhimbili University College of Health Sciences
NIH	National Institutes of Health
PAID	Problem Areas in Diabetes

SDSCA	Summary of Diabetes Self-Care Activities
SMBG	Self Monitoring of Blood Glucose
UK	United Kingdom
UKPDS	UK Prospective Diabetes Study
WC	Waist Circumference
WHO	World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Diabetes mellitus is a series of disorders or syndrome in which the body is unable to properly regulate the processing or metabolism of carbohydrate, fat and protein (Wright, 2003). There are mainly two type of diabetes, Type 1 and Type 2. Type 1 diabetes (formerly called juvenile-onset or insulin-dependent diabetes), accounts for 5 to 10% of all people with diabetes. Type 1 diabetes arises because of gradual and progressive autoimmune destruction of β-cells in the Islets of Langerhans which produce insulin. Type 2 diabetes (formerly called mature-onset or non–insulin-dependent diabetes) can develop at any age, but most commonly becomes apparent during adulthood. Type 2 diabetes accounts for the vast majority of people with diabetes 90 to 95% of all cases. It is caused by a combination of insulin resistance and impaired insulin secretion (Grimson, 2005).

1.2 Global Diabetes Situation

The prevalence of diabetes mellitus is increasing around the world and at a rate that has been characterized as an epidemic (Mokdad *et al.,* 2000; Boyle *et al.,* 2001). This increase is almost entirely due to increased prevalence of Type 2 diabetes mellitus. The incidence of Type 1 diabetes mellitus has remained relatively stable in comparison with that of type 2 DM (Kelley, 2003). The prevalence of diabetes for all age groups worldwide was estimated to be 2.8% in 2000 and is projected to be 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030 worldwide (Wild *et al.,* 2004).

1.3 Tanzania Situation

In Tanzania, about 80% of the newly diagnosed diabetic patients have Type 2 diabetes mellitus. Most new patients present with classic symptoms of diabetes (thirst, tiredness, and weight loss) (MOH, 1997). Tanzania has already experienced a rapid rise in the burden of diabetes. In the 1980s, the prevalence of Type 2 diabetes was among the lowest in the world: 0.8% in cities and towns and 0.9% in rural areas. A study in 2000 highlighted a marked increase in diabetes in urban (4.0%) and rural (1.3%) populations, and now 300,000 - 350,000 of Tanzania's 35 million people has diabetes (Ramaiya, 2005). Diabetes in Tanzania is placing an increasing economic burden on the population and on the national budget for health care. A study in the Kilimanjaro region showed that, the total direct costs relating to the treatment of diabetes accounted for a quarter of the minimum wage, resulting in about 46% of the patients having permanent financial difficulties. Research from Dar es Salaam reported that, only 1 in 5 of people with diabetes was receiving government-funded treatment for the disease (Ramaiya, 2005).

According to Tanzania Adult Morbidity and Mortality report (1995), the proportions of all male deaths associated with diabetes were 2.6%, 2.1% and 0.1% in Dar es Salaam, Hai and Morogoro rural district, respectively. In women the proportions were 1.7%, 1.8% and 0.2 % in Dar es Salaam, Hai and Morogoro district, respectively. Despite the low prevalence of diabetes in Tanzania, diabetes mortality rates are higher than or comparable to those in Mauritius and the United States (MOH, 1997; McLarty, 1996).

Diabetes is a life-long challenge that needs behavioural change, most often through education, feeding and support. Self-care in diabetes is crucial to keep the illness under control. Self care comprises a set of skilled behaviours meant to promote health and

prevent complications and is usually called self-management. Self care for diabetic patients involves a complex array of care behaviours including taking medications, adhering to specific diet regime, engaging in regular exercises, monitoring blood glucose and caring for the feet (Heisler *et al.,* 2003). The main goal in diabetes care is to ensure good quality of life, good metabolic control and to minimize complications caused by diabetes (Sigurdardo, 2004). Rubin and Peyrot (1992) suggested that, to perform self-care, the ill person needs physical skills, cognitive function and an awareness of how psychological factors affect self-care. Paterson and Thorne (2000) demonstrated that, learning to master self-care in diabetes is a process which the person attempts a variety of self-care strategies, according to her/his unique body's cues, until discovering what is effective for his/her lifestyle and contextual situation.

Research has shown that, psychological distress frequently occurs in people with diabetes and is often related to difficulties in coping with the daily diet regimen and worries about developing late complications (Rubin and Peyrot, 1992; Gafvels *et al.,* 1993). Psychological distress is not only burdensome, but it can also impede the self-care behaviours of the patients, thereby compromising glycemic control (Mazze *et al.,* 1984; Aikens *et al.,* 1992; Metsch *et al.,* 1995).

1.4 Problem Statement and Justification

Nutritional intake and modification of lifestyle are the cornerstones for management of Type 2 diabetes. It has been recognized that, in order to achieve satisfactory metabolic control, adoption of self-care skills by the person with diabetes are crucial. Effective management lies almost entirely on the hands of the patient, who lives with the condition (Griffin, 1998; Heisler *et al.,* 2003). Self-care needs a great deal of empowerment on the

part of the patient. People are empowered when they have knowledge, skills, attitudes and self-awareness necessary to influence their own behaviour and that of others in order to improve the quality of their lives (Funnell, 1991). The World Health Organization alluded to empowerment in its paper on health promotion as "the process of enabling people to increase control over, and to improve their health" (WHO, 1978).

In a study done by Smide *et al.* (2002), Tanzania diabetics were found to be dissatisfied with the supply of drugs and wanted more education on diabetes. Since there was limited documentation on psychosocial distress among Tanzanian diabetics and their actual practices have not been well explored, there was a need to explore these issues extensively so that the knowledge obtained could be used in improving care of diabetics. This study was designed to fill the gap of knowledge on diabetic self-care practices and psychosocial distress in Tanzania. The aim of this study was to determine the self-care practices and psychosocial distress of Type 2 diabetics in Dar es Salaam. The study would be a basis for proposing action to empower the diabetic patients so that they can improve their quality of life and increase survival.

1.5 Study Conceptual Framework

The conceptual framework details the variables that will be used in the study and their expected relationship. A framework binds facts together and provides guidance towards realistic collection of data and information (Katani, 1999). Psychosocial aspects, economic and demographic aspects and the level of education influence the level of self-care in terms of diet, exercises, glucose monitoring, adhering to medication and foot-care. The detailed conceptual framework is shown in Figure 1.

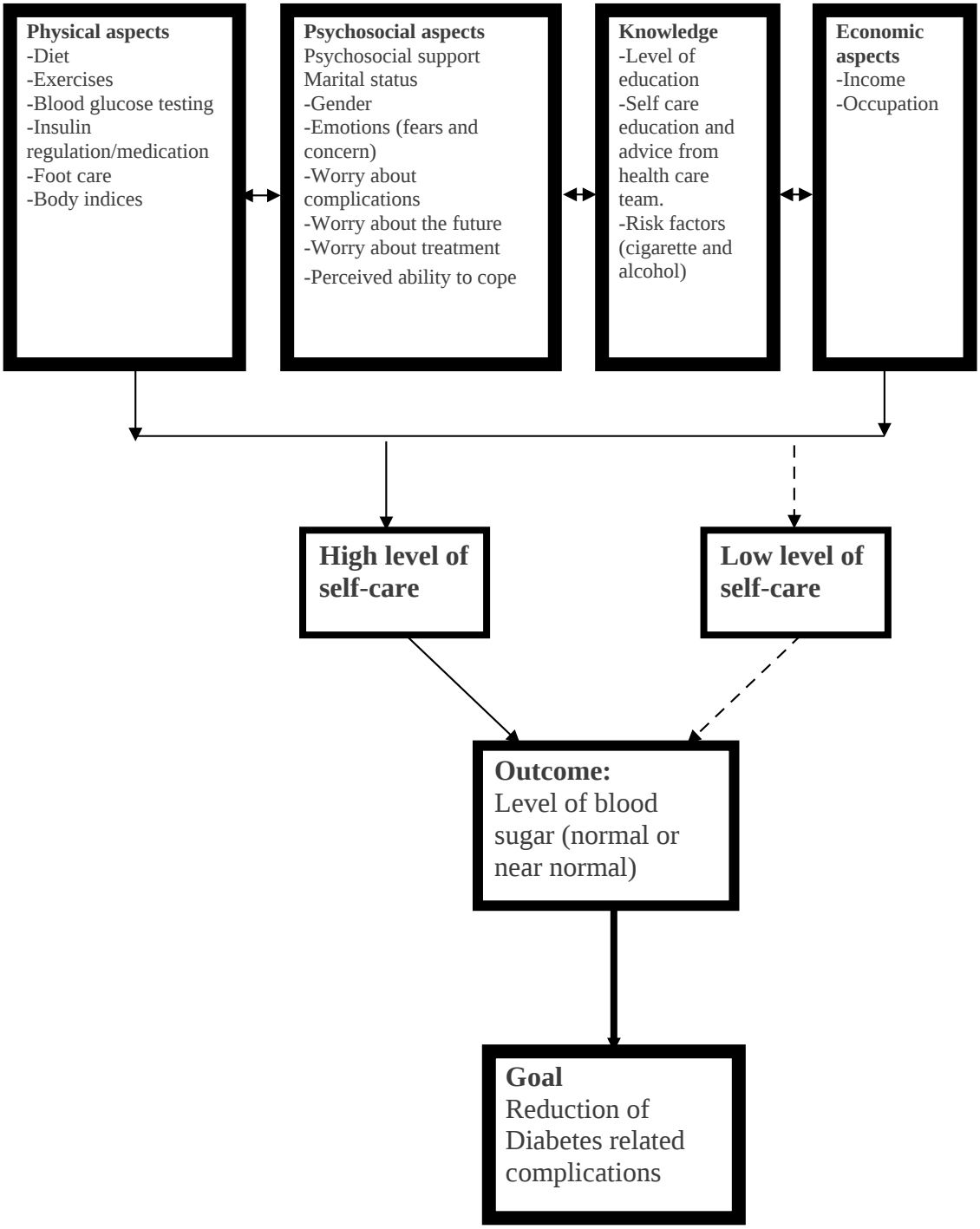

Figure 1: Conceptual framework showing association of physical, psychosocial, knowledge, and economic aspects to the diabetics self-care practices and careoutcomes

1.6 Overall Objective

To determine self care practices and psychosocial distress for people with Type 2 diabetes mellitus in Dar es Salaam, Tanzania.

1.6.1 Specific objectives

(a) To assess the nutritional status, body composition and fasting blood glucose of people with Type 2 diabetes mellitus. These include, weight and height, waist, hip and upper arm circumferences, fasting blood glucose and level of blood pressure.

(b) To determine the proportion of diabetics who engage in various self-care activities - dietary related practices, physical activities/exercise, foot care and smoking practices.

(c) To determine psychosocial distress among people with Type 2 diabetes mellitus in Dar es Salaam including, psychosocial support, ability to cope with the disease, medical support provided and emotions (fears and concerns).

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Diabetes Mellitus Overview

Diabetes mellitus is a major global health problem. The number of people known to be affected worldwide has risen dramatically. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030 worldwide, (Wild *et al.,* 2004). Of those affected, approximately 90% will have Type 2 diabetes. The number of deaths attributed annually to diabetes is estimated at over 800,000. However, most diabetics die from other chronic conditions, such as cardiovascular disease. Diabetes mellitus is a chronic disease caused by inherited and/or acquired deficiency in production of insulin by the pancreas, or by the ineffectiveness of the insulin produced (WHO, 2003). Diabetes is associated with increased risk of morbidity and mortality caused by complications associated with this chronic disease.

2.1.1 Insulin resistance and type 2 diabetes.

Type 2 diabetes usually results from a combination of peripheral insulin resistance and defects in β-cell function. Analysis in humans has identified specific genetic defects associated with early-onset forms of diabetes, but a common molecular mechanism for the majority of cases of type 2 diabetes has yet to be identified (White, 2000). Recent results from a number of murine knockout and transgenic models suggest that disruption of insulin/insulin-like growth factor (IGF)-1 signalling mechanisms, and in particular, alteration in the function of insulin-receptor substrate (IRS) proteins, might contribute to defects in both peripheral insulin action and β-cell function. So far, significant mutations in these core-signalling elements have not been found in type 2 diabetes; however,

dysregulation of diverse signalling pathways that regulate the function of the IRS-proteins might play significant roles in the development of diabetes (White, 2000).

2.1.2. Diabetic complications

2.1.2.1 Cardiovascular diseases (CVD)

The major cause of morbidity and mortality affecting people with type 2 diabetes is cardiovascular disease (CVD), through ischaemic heart disease (myocardial infarction, angina, cardiac failure and sudden cardiac death), cerebrovascular disease (stroke) and peripheral vascular disease (claudication, gangrene, amputation and renovascular disease). People with diabetes suffer a marked excess of these conditions compared with non-diabetic people (Pyörälä *et al.*, 1987; Laakso and Lehto, 1997).

Hypertension is diagnosed in about 50% of patients who have Type 2 diabetes and is a major pathophysiologic mechanism for arterial damage leading to diabetic nephropathy and cardiovascular disease (Estacio and Schrier, 1998; Bakris *et al.*, 2000). It is well established that hypertension increases the risks for cardiovascular and renal morbidity and mortality, and that control of elevated blood pressure (BP) can significantly reduce these risks (Sequeira *et al.*, 2004).

CVD accounts for approximately 50% of all deaths among people with diabetes in industrialized countries. Risk factors for heart disease in people with diabetes include high blood pressure, high serum cholesterol, obesity and smoking. Recognition and management of these conditions may delay or prevent heart disease in people with diabetes (WHO, 2003).

Evidence suggests that, diabetes and cardiovascular disease (CVD) may share an underlying cause(s), a theory known as the ‘common soil’ hypothesis. Insulin resistance is central both to the progression from normal glucose tolerance to type 2 diabetes and to a constellation of cardiovascular risk factors known as the metabolic syndrome. These risk factors include visceral obesity and dyslipidaemia characterized by low levels of high-density lipoprotein cholesterol, hypertriglyceridaemia and raised small dense low-density lipoprotein particle levels. Changes in adipose tissue mass and metabolism may link insulin resistance and visceral obesity, a condition that is common in type 2 diabetes. Furthermore, weight reduction, increased physical activity, diabetic medications such as metformin and acarbose have been shown to reduce the development of type 2 diabetes in genetically predisposed subjects and may decrease the high cardiovascular risk of patients with diabetes (Lebovitz, 2005). In addition to microvascular complications, individuals with type 2 diabetes have a markedly increased risk of macrovascular disease. The incidence of first myocardial infarction (MI) has been shown to be more than five times greater in patients with diabetes than in nondiabetic control subjects and was similar to the incidence for non-diabetic patients with prior MI. Control of blood glucose levels, blood pressure, and cholesterol levels is proven to reduce the risk of vascular disease among individuals with diabetes mellitus (Saydah *et al.*, 2004).

2.1.2.2 Diabetic neuropathies

The diabetic neuropathies affect different parts of the nervous system that present with diverse clinical manifestations. They may be focal or diffuse. Most common among the neuropathies are chronic sensorimotor distal symmetric polyneuropathy (DPN) and the autonomic neuropathies (Boulton *et al.*, 2005a). Diabetic neuropathy is probably the most common complication. Studies suggest that up to 50% of people with diabetes are affected

to some degree. Major risk factors for this condition are the level and duration of elevated blood glucose. Neuropathy can lead to sensory loss and damage to the limbs. It is also a major cause of impotence in diabetic men (WHO, 2003).

2.1.2.2.1 Chronic sensorimotor distal symmetric polyneuropathy (DPN).

This is the most common presentation of neuropathy in diabetes, and up to 50% of patients may experience symptoms, most frequently burning pain, electrical or stabbing sensations, parasthesiae, hyperasthesiae, and deep aching pain. Neuropathic pain is typically worse at night, and the symptoms are most commonly experienced in the feet and lower limbs, although in some cases the hands may also be affected. As up to half of the patients may be asymptomatic, a diagnosis may only be made on examination or, in some cases, when the patient presents with a painless foot ulcer (Boulton *et al.*, 2005a).

2.1.2.2.2 Autonomic neuropathy

Diabetic autonomic neuropathy (DAN) results in significant morbidity and may lead to mortality in some patients with diabetes. Major clinical manifestations of DAN include resting tachycardia, exercise intolerance, orthostatic hypotension, constipation, gastroparesis, erectile dysfunction, pseudomotor dysfunction, impaired neurovascular function and hypoglycemic autonomic failure. Prevalence data for DAN range from 1.6 to 90% depending on tests used, populations examined, and type and stage of disease. Risk factors for the development of DAN include diabetes duration, age, and long-term poor glycemic control. DAN may cosegregate with factors predisposing to macrovascular events such as raised blood pressure and dyslipidemia. Thus, in addition to good glycemic control, lipid modulation and blood pressure control may be beneficial in the prevention of DAN (Boulton *et al.*, 2005a).

2.1.2.3 Diabetic retinopathy

Diabetic retinopathy is the most frequent cause of new cases of blindness among adults aged 20-74 years. During the first two decades of disease, nearly all patients with type 1 diabetes and >60% of patients with type 2 diabetes have retinopathy (Fong et al., 2004). Research findings suggest that, after 15 years of diabetes, approximately 2% of people become blind, while about 10% develop severe visual handicap (WHO, 2003).

Diabetic retinopathy progresses from mild nonproliferative abnormalities, characterized by increased vascular permeability, to moderate and severe nonproliferative diabetic retinopathy (NPDR), characterized by vascular closure, to proliferative diabetic retinopathy (PDR), characterized by the growth of new blood vessels on the retina and posterior surface of the vitreous. Macular oedema, characterized by retinal thickening from leaky blood vessels, can develop at all stages of retinopathy. Pregnancy, puberty, blood glucose control, hypertension, and cataract surgery can accelerate these changes. The duration of diabetes is probably the strongest predictor for development and progression of retinopathy (Fong *et al.,* 2004). Treatment modalities exist that can prevent or delay the onset of diabetic retinopathy, as well as prevent loss of vision, in a large proportion of patients with diabetes. The DCCT (1993) and the UKPDS (1998) established that glycemic and blood pressure control could prevent and delay the progression of diabetic retinopathy in patients with diabetes.

2.1.2.4 Kidney failure

Hyperglycaemia is the antecedent to the occurrence of renal complications in diabetes mellitus. Two different points of views have been suggested in order to describe the relationship between the abnormalities of blood glucose level and the development of

renal complications. Data from the Diabetes Control and Complications Trial Research Group (DCCT, 1993) trial in type 1 diabetes and the UK Prospective Study Group (UKPDS 1998) in type 2 diabetes, showed a linear inverse relationship between hyperglycaemia and renal-retinal complications. More particularly, a 37% decrease in the incidence rate of micro-macroalbuminuria and retinal complications was observed in the UKPDS study for any decrease of HbA1c by 1%. Diabetes is among the leading causes of kidney failure, but its frequency varies between populations and is also related to the severity and duration of the disease (WHO, 2003).

2.1.2.5 Diabetic foot

Diabetic foot disease, caused by changes in blood vessels and nerves, often leads to ulceration and subsequent limb amputation. Foot wounds are the most common diabetes-related cause of hospitalisation and is the most common cause of non-traumatic amputation of the lower limb (Boulton and Vileikyte, 2000; WHO, 2003; and Boulton *et al.*, 2005b). Individuals with diabetes have a 30-fold higher lifetime risk of undergoing a lower-extremity amputation compared with those without diabetes (Lavery, *et al.*, 1996 and Lavery *et al.*, 1999). Among people with diabetes, 15% will experience a foot ulcer in their lifetime and about 14–24% of people with a foot ulcer will require an amputation (ADA, 1999). Foot infections almost invariably occur in patient who sustains a foot wound especially if the wound is of long duration and penetrate to underlying bone or if the patient has coexisting peripheral vascular disease or recurrent foot wound. High amputation risk is associated with foot infection in diabetic patients (Lavery *et al.*, 2006).

In order to prevent foot ulcer and foot infections, diabetic patients are advised to inspect their feet every day and seek care as early as possible if they get foot injury. Diabetic

patients are also advised to make sure that, their feet are checked by a health care provider at least once a year or more often if they have foot problems (ADA, 2006a).

2.1.2.6 Diabetes and dyslipidaemia

Diabetic dyslipidaemia is characterized by hypertriglyceridaemia, low levels of high-density lipoprotein cholesterol (HDL-C) and the presence of small, dense low-density lipoprotein (LDL) particles (Schwartz, 2005). The most common pattern of dyslipidaemia in patients with Type 2 diabetes is elevated triglyceride levels and decreased HDL cholesterol levels. The mean concentration LDL cholesterol in those with Type 2 diabetes is not significantly different from those individuals who do not have diabetes. However, qualitative changes in LDL cholesterol may be present. In particular, patients with diabetes tend to have higher proportion of smaller and denser LDL particles which are more susceptible to oxidation and may thereby increase the risk of cardiovascular events (ADA, 2004d).

Diabetic dyslipidaemia is a major contributor to the high risk of morbidity and mortality from CVD in diabetic individuals and individuals predisposed to diabetes. Weight loss and increased physical activity can prevent or delay the development of Type 2 diabetes and diabetic dyslipidaemia, and these lifestyle changes, in addition to improved glycaemic control, are appropriate steps for the initial management of diabetic patients with dyslipidaemia, especially hypertriglyceridaemia. If lipid-lowering goals are not met by lifestyle modification and improved glycaemic control, the use of lipid-lowering medications in conjunction with antidiabetic agents (oral agents or insulin) should be considered. Patients will eventually need insulin therapy owing to the chronic course of Type 2 diabetes; however, insulin may be initiated early in cases of diabetic dyslipidaemia

because of the positive effects of insulin on reduction of triglyceride levels (Schwartz, 2005).

2.2 Glycaemic Control and Blood Glucose Testing

United Kingdom prospective diabetes study (UKPDS, 1998), a large, multicentre, randomised controlled trial showed that, in Type 2 diabetes mellitus late complications are linked to glycaemic control, thus justifying the aim of near-normoglycaemia. UKPDS employed fasting blood glucose (FBG)-based therapeutical approach, owing to the relevance of FBG in the metabolic control of type 2 diabetes. For clinical purposes, FBG was assumed to represent a stable ideal line connecting the different preprandial values (i.e. a stable BG preprandial baseline), on which postprandial excursions are superimposed; thus, it was expected that optimisation of FBG resulted in improvement of daily glycaemic control (UKPDS, 1995).

The value of tight blood glucose control in Type 2 diabetes has been convincingly demonstrated in UKPDS, that improvement in glycemic control per se, irrespective of the means of attaining it, is the critical factor in reducing the risk of chronic diabetic complications (UKPDS, 1998). Gaining and maintaining good glycemic control hinges on enhancing insulin availability or secretion and overcoming insulin resistance.

2.3 Diabetes and Weight Changes

In the study to examine the natural history of weight changes before and after diagnosis of diabetes, Lookers *et al.* (2001) found that, before development of diabetes, there was a progressive rise in weight, and after diagnosis, there was a tendency toward weight loss.

When current treatment was considered, there was greater weight stability in individuals taking insulin compared with those not taking hypoglycaemic medication.

For most diabetic patients who are on antidiabetic medication, weight gain with such pharmacotherapy is common and can be quite large. The U.K. Prospective Diabetes Study showed that, after an initial weight loss with dietary instruction, Type 2 diabetic patients showed a gradual but impressive weight gain over a period of 15 years of treatment with drugs (UKPDS, 1998). With new standards of care that are setting lower blood glucose levels, more medications are used that enhance anabolism and weight gain. These medications include sulfonylureas, meglitinides, insulin, and thiazolidinediones. Thus, the effort to drive blood glucose down to prevent complications clashes with the effort to lower weight (Pi-Sunyer, 2005).

Obesity is a risk factor for morbidity and mortality among people with diabetes. Leibson *et al.* (2001), has demonstrated that, the prevalence of obesity and extreme obesity among individuals at the time they first meet the criteria for diabetes has been increasing over time. This means that, the use of drugs and other diabetic management techniques by diabetic patients led to increase of their weight over time and put them at an increased risk of morbidity and mortality.

In addition, it has been established that, abdominal obesity, assessed by waist circumference (WC), predicts obesity-related health risk (WHO, 1998; Rexrode *et al.*, 1998; Zhu et *al.*, 2002), and the weighted evidence indicates that WC coupled with BMI predicts health risk better than does BMI alone (Rexrode *et al.*, 1998; Janssen *et al.*, 2002;

Ardern *et al.,* 2003). In fact, recent findings indicate that WC is a stronger marker of health risk than BMI.

2.4 Factors Contributing to Type 2 DM Epidemic

Many factors have been postulated to contribute to the Type 2 DM epidemic. Environmental factors have drawn particular attention because of the rapidity of the increase in Type 2 DM. Most notable is the increase in the prevalence of obesity that has paralleled the rise in Type 2 DM and the interrelated aspect of sedentary lifestyle. Weight loss and exercise have both been shown to reduce insulin resistance, a major physiological defect related to the development of diabetes, and to improve glycemic control. These interventions also ameliorate hypertension and lipid abnormalities and thus may contribute to reduction in risk of coronary heart disease (CHD) in individuals with Type 2 diabetes (Rena *et al.,* 2001). The diabetic patients are required to perform self care activities in the area of diet, exercises, blood glucose testing and medication in order to be able to control their level of blood glucose and thus reduce the chance of diabetic related complications.

2.4.1 Diet

The ways diabetics eat food and their timing with their drugs regimen helps in regulating glycemic index for those individual. The health care workers are supposed to work with diabetic patients in helping them to plan their diets. Diet plays a key role in the management of diabetes mellitus and in the prevention of its complications. Results from the Diabetes Control and Complications Trial (DCCT, 1993) and the UK. Prospective Diabetes Study (UKPDS, 1998) convincingly demonstrated the importance of glycemic control in preventing the microvascular complications of diabetes. American Diabetic Association (ADA, 2004a) has brought forward evidence based nutrition principles and

recommendations in diabetes which are used as references. According to ADA (2004a), the goals of nutrition therapy are the following: -

(a) Attain and maintain optimal metabolic outcomes including:-

- Blood glucose levels in the normal range or as close to normal as possible to prevent or reduce the risk for complications of diabetes;
- A lipid and lipoprotein profile that reduces the risk for macrovascular disease;
- Blood pressure levels that reduce the risk for vascular disease;

(b) Prevent and treat the chronic complications of diabetes. Modify nutrient intake and lifestyle as appropriate for the prevention and treatment of obesity, dyslipidemia, Cardiovascular disease, hypertension, and nephropathy.

(c) Improve health through healthy food choices and physical activity.

(d) Address individual nutritional needs taking into consideration personal and cultural preferences and lifestyle while respecting the individual's wishes and willingness to change.

2.4.1.1 Carbohydrate and diabetes

When referring to common food, carbohydrates, such as sugars, starch, and fiber are the most preffered forms. Carbohydrates (CHOs) such as simple sugars and fast-acting carbohydrates are high glycemic forms and should be avoided. Studies in healthy subjects and those at risk for Type 2 diabetes support the importance of including foods containing carbohydrate, particularly from whole grains, fruits, vegetables, and low-fat milk in the diet of people with diabetes. A number of factors influence glycemic responses to foods, including the amount of carbohydrate, type of sugar (glucose, fructose, sucrose, lactose), nature of the starch (amylose, amylopectin, resistant starch), cooking food processing

(degree of starch gelatinisation, particle size, cellular form), and food form, as well as other food components (fat and natural substances that slow digestion -lectins, phytates, tannins, and starch-protein and starch-lipid combinations).

Glycemic index: Although low glycemic index diets may reduce postprandial glycaemia, the ability of individuals to maintain these in diets long-term (and therefore achieve glycemic benefit) has not been established.

Fiber: As for the general population, people with diabetes are encouraged to choose a variety of high-fiber foods, such as whole grains, fruits, and vegetables, because they provide vitamins, minerals, fiber, and other substances important for good health.

Sweeteners: The available evidence from clinical studies demonstrates that, dietary sucrose does not increase glycaemia more than isocaloric amounts of starch. Thus, intake of sucrose and sucrose containing foods by people with diabetes does not need to be restricted because of concern about aggravating hyperglycaemia. Sucrose should be substituted for other carbohydrate sources in the food/ meal or, if added to the food/meal, they must adequately be covered with insulin or another glucose-lowering medication.

In subjects with diabetes, fructose produces a lower postprandial response when it replaces sucrose or starch in the diet; however, this benefit is tempered by concern that fructose may adversely effect plasma lipids. Therefore, the use of added fructose as a sweetening agent is not recommended; however, there is no reason to recommend that people with diabetes should avoid naturally occurring fructose in fruits, vegetables, and other foods.

Sugar alcohols produce a lower postprandial glucose response than fructose, sucrose, or glucose and have lower available energy values. However, there is no evidence that the amounts likely to be consumed in a meal or day results in a significant reduction in total daily energy intake or improvement in long-term glycaemia. The use of sugar alcohols appears to be safe; however, they may cause diarrhoea, especially in children.

Carbohydrate recommendations

- Foods containing carbohydrate from whole grains, fruits, vegetables, and low-fat milk should be included in a healthy diet;
- With regard to the glycemic effects of carbohydrates, the total amount of carbohydrate in meals or snacks is more important than the source or type;
- As sucrose does not increase glycaemia to a greater extent than isocaloric amounts of starch, sucrose and sucrose- containing foods do not need to be restricted by people with diabetes; however, they should be substituted for other carbohydrate sources or, if added, it should be covered with insulin or other glucose-lowering medication;
- Non-nutritive sweeteners are safe when consumed within the acceptable daily intake levels recommended by the Food and Drug Administration;

Expert consensus

- Carbohydrate and monounsaturated fat together should provide 60–70% of energy intake. However, the metabolic profile and the need for weight loss should be considered when determining the monounsaturated fat content of the diet;
- Sucrose and sucrose-containing foods should be eaten in the context of a healthy diet;

2.4.1.2 Protein and diabetes

A number of studies in healthy subjects and in persons with controlled Type 2 diabetes have demonstrated that, glucose from ingested protein does not appear in the general circulation, and therefore protein does not increase plasma glucose concentrations. Furthermore, the peak glucose response to carbohydrate alone is similar to that of carbohydrate and protein, suggesting that protein does not slow the absorption of carbohydrate.

Recommendations

- In persons with controlled Type 2 diabetes, ingested protein does not increase plasma glucose concentrations, although protein is just as potent a stimulant of insulin secretion as carbohydrate;
- For persons with diabetes, especially those not in optimal glucose control, the protein requirement may be greater than the Recommended Dietary Allowance, but not greater than usual intake;

Expert consensus

- For persons with diabetes, there is no evidence to suggest that usual protein intake (15–20% of total daily energy) should be modified if renal function is normal;
- The long-term effects of diets high in protein and low in carbohydrate are unknown. Although such diets may produce short-term weight loss and improved glycaemia, it has not been established that weight loss is maintained in long-term. The long-term effect of such diets on plasma LDL cholesterol is also a concern;

2.4.1.3 Dietary fat and diabetes

Fatty acids and dietary cholesterol

The primary dietary goal in persons with diabetes is to limit intake of saturated fat and dietary cholesterol. Saturated fat is the principal dietary determinant of plasma LDL cholesterol. Furthermore, persons with diabetes appear to be more sensitive to dietary cholesterol than the general public**.**

Recommendations

- Less than 10% of energy intake should be derived from saturated fats. Some individuals (i.e., persons with LDL cholesterol ≥100 mg/dl) may benefit from lowering saturated fat intake to <7% of energy intake;
- Dietary cholesterol intake should be <300 mg/day. Some individuals (i.e., persons with LDL cholesterol ≥100 mg/dl) may benefit from lowering dietary cholesterol to <200 mg/ day;
- To lower LDL cholesterol, energy derived from saturated fat can be reduced if weight loss is desirable or be replaced with either carbohydrate or monounsaturated fat when weight loss is not a goal;
- Intake of trans-unsaturated fatty acids should be minimized;
- Maintaining low fat diet for a long-term may contribute to modest loss of weight and improvement in dyslipidemia;
- Two to three servings of fish per week provide dietary n - 3 polyunsaturated fat and this is good for the body;

2.4.1.4 Energy balance and obesity

Because of the effects of obesity on insulin resistance, weight loss is an important therapeutic objective for persons with Type 2 diabetes. Short-term studies have demonstrated that, weight loss in subjects with Type 2 diabetes is associated with decreased insulin resistance, improved measures of glycaemia and dyslipidemia, and reduced blood pressure.

Recommendations

- In insulin-resistant individuals, reduced energy intake and modest weight loss improve insulin resistance and glycaemia in the short-term;
- Structured programs that emphasize lifestyle changes, including education, reduced fat (<30% of daily energy) and energy intake, regular physical activity, and regular participant contact, can produce long-term weight loss on the order of 5–7% of starting weight;
- Exercise and behaviour modification are most useful as adjuncts to other weight loss strategies. Physical exercise is helpful in maintenance of weight loss;
- Standard weight reduction diets, when used alone, are unlikely to produce long-term weight loss. Structured intensive lifestyle programs are necessary;

2.4.1.5 Micronutrients and diabetes

Persons with diabetes should be educated about the importance of consuming adequate amounts of vitamins and minerals from natural food sources as well as the potential toxicity of megadoses of vitamin and mineral supplements. Although difficult to ascertain, if deficiencies of vitamins and minerals are identified, supplementation can be beneficial.

Recommendations

- There is no clear evidence of benefit from vitamin or mineral supplementation in people with diabetes who do not have underlying deficiencies. Exceptions include folate for prevention of birth defects and calcium for prevention of bone disease;
- Routine supplementation of the diet with antioxidants is not advised because of uncertainties related to long-term efficacy and safety;

2.4.1.6 Alcohol and diabetes

For persons with diabetes, the same precautions apply regarding the use of alcohol as applies to the general population. Abstention from alcohol should be advised for women during pregnancy and for people with other medical problems such as pancreatitis, advanced neuropathy, severe hypertriglyceridemia, or alcohol abuse. If individuals choose to drink alcohol, no more than two alcohol containing drinks per day for adult men and no more than one drink per day for adult women is recommended. One drink, or alcoholic beverage, is commonly defined as 12 oz of beer, 5 oz of wine, or 1.5 oz of distilled spirits, each of which contains ~15 g of alcohol. The cardioprotective effects of alcohol appear not to be determined by the type of alcoholic beverage consumed.

Recommendations

- If individuals choose to drink alcohol daily, intake should be limited to one drink for adult women and two drinks for adult men;
- To reduce risk of hypoglycaemia, alcohol should be consumed with food. Alcohol can have both hypoglycaemic and hyperglycaemic effects in people with diabetes. These

effects are determined by the amount of alcohol acutely ingested, if consumed with or without food and if use is chronic and excessive;

2.4.2 Exercise

Exercise improves insulin resistance and has beneficial effects in preventing and ameliorating the conditions of Type 2 diabetes. Unfortunately, central obesity, advancing age, and physical inactivity hinder medical management and may hasten development of chronic complications, particularly in elderly people who may have lived with diabetes for decades. Even when glycemic control is near optimal with medication, reducing insulin resistance by any other means must be explored in view of these adverse consequences.

Because skeletal muscle is the biggest reservoir for glucose disposal (De Fronzo *et al.*, 1981; Wiley *et al.*, 2003), muscle wasting from inactivity and aging exacerbate problems of peripheral glucose uptake. Muscle weakness, decreased muscle mass, decreased activation of glycogen synthase, and changes in type IIb skeletal muscle fiber numbers are related to and may precede insulin resistance, glucose intolerance, and Type 2 diabetes (Nyholm *et al.,* 1997; Albright *et al.,* 2000). Visceral fat deposition in older adults may be causally related to elevated cortisol secretonin response to stressors (Epel *et al.*, 2000). Thus, decreased muscle mass, increased viscera adiposity, and the typical decline in physical activity with age compound insulin resistance.

Exercise directly targets the metabolic derangements of diabetes compared with many medications that primarily increase available insulin supply. Moreover, most medications can only be used once the fasting glucose levels rise and may produce hypoglycaemia if used in patients with very mild diabetes or in the elderly. Exercise can reduce the need for

medication as well as improve cardiovascular risk factors such as hypertension, dyslipidemia, and elevated fibrinolytic activity (Albright *et al.*, 2000).

During physical activity, whole-body oxygen consumption may increase by as much as 20-fold, and even greater increases may occur in the working muscles. To meet its energy needs under these circumstances, skeletal muscles use, at a greatly increased rate, its own stores of glycogen and triglycerides, as well as free fatty acids (FFAs) derived from the breakdown of adipose tissue triglycerides and glucose released from the liver. To preserve central nervous system function, blood glucose levels are remarkably well maintained during physical activity. The metabolic adjustments that preserve normoglycemia during physical activity are in large part controlled by hormones. A decrease in plasma insulin and the presence of glucagons appear to be necessary for the early increase in hepatic glucose production during physical activity, and during prolonged exercise, increases in plasma glucagons and catecholamines appear to play a key role. These hormonal adaptations are essentially lost in insulin-deficient patients with Type 1 diabetes. As a consequence, when such individuals have too little insulin in their circulation due to inadequate therapy, an excessive release of counterinsulin hormones during physical activity may increase already high levels of glucose and ketone bodies and can even precipitate into diabetic ketoacidosis. Conversely, the presence of high levels of insulin, due to exogenous insulin administration, can attenuate and even prevent the increased mobilization of glucose and other substrates induced by physical activity, leading to hypoglycaemia. Similar concerns exist in patients with Type 2 diabetes on insulin or sulfonylurea therapy. In general, hypoglycaemia during physical activity tends to be less of a problem in this population. Indeed, in patients with Type 2 diabetes, physical activity

may improve insulin sensitivity and assist in diminishing elevated blood glucose levels into the normal range (ADA, 2004b).

2.4.2.1 Evaluation of the patient before exercise

Before ENTERING physical activity programme or an exercise program, the individual with diabetes mellitus should undergo a detailed medical evaluation with appropriate diagnostic studies. This examination should carefully screen for the presence of macro- and microvascular complications that may be worsened by the physical exercise. Identification of areas of concern will allow the design of an individualized exercise that can minimize risk to the patient (ADA, 2004b).

2.4.2.2 Preparing for exercise

Preparing the individual with diabetes for safe and enjoyable physical activity program is as important as physical activity itself. The young individual in good metabolic control can safely participate in most activities. The middle-aged and older individual with diabetes should be encouraged to be physically active. The aging process leads to a degeneration of muscles, ligaments, bones, and joints and diabetes may exacerbate the problem. Before beginning any physical activity program, the individual with diabetes should be screened thoroughly for any underlying complications.

A standard recommendation for diabetic patients, as for nondiabetic individuals, is that, physical activity includes a proper warm-up and cool-down period. A warm-up should consist of 5–10 min of aerobic activity (walking, cycling, etc.) at a low intensity level. The warm-up session is to prepare the skeletal muscles, heart, and lungs for a progressive increase in exercise intensity. After a short warm-up, muscles should be gently stretched

for another 5–10 min. Primarily, the muscles used during the active physical activity session should be stretched, but warming up all muscle groups is optimal. The active warm-up can either take place before or after stretching. After the activity session, a cool-down should be structured similarly to the warm-up. The cool-down should last about 5–10 min and gradually bring the heart rate down to its pre-exercise level (ADA, 2004b).

2.4.3 Blood glucose test

Monitoring of glycemic status, as performed by patients and health care providers, is considered a cornerstone of diabetes care. Results of monitoring are used to assess the efficacy of therapy and to guide adjustments in nutrition therapy, exercise, and medications to achieve the best possible blood glucose control (ADA, 2004c).

Recommendations

- Based on the DCCT results, it is recommended that, most individuals with diabetes should attempt to achieve and maintain blood glucose levels as close to normal as is safely possible. Because most patients with type 1 diabetes can achieve this goal only by using SMBG, all treatment programs should encourage SMBG for routine daily monitoring. Daily SMBG is important for patients treated with insulin or sulfonylureas to monitor for and prevent symptomatic hypoglycaemia. Frequency and timing of glucose monitoring should be dictated by the needs and goals of the individual patient, but for most patients with type 1 diabetes, SMBG is recommended three or more times daily. The optimal frequency of SMBG for patients with type 2 diabetes is not known, but should be sufficient to facilitate reaching glucose goals. Thus, the frequency of surveillance should be such that, risks for both hyper- and hypoglycaemic episodes are

minimized. When adding to or modifying therapy, Type 1 and Type 2 diabetic patients should test more often than usual. The role of SMBG in stable diet-treated patients with type 2 diabetes is not known.

- SMBG is recommended for all insulin treated patients with diabetes. SMBG may be desirable in patients treated with sulfonylureas or other insulin secretagogues and in all patients not achieving glycemic goals. Data indicate that only a minority of patients perform SMBG (ADA, 2004c). Efforts should be made to substantially increase the use of SMBG. Barriers to increasing use of SMBG include cost of testing, inadequate understanding by both health care providers and patients about the health benefits and proper use of SMBG results, patient psychological and physical discomfort associated with finger-prick blood sampling, and inconvenience of testing in terms of time requirements, physical setting, and complexity of the technique. Given the importance of SMBG to diabetes care, government, third-party payers, and others should strive to make the procedure readily accessible and affordable for all patients who require it. Thus, SMBG should be an important component of any health care package.
- Because the accuracy of SMBG is instrument and user dependent, it is importantfor health care providers to evaluate each patient’s monitoring technique, both initially and at regular intervals thereafter. Use of calibration and control solutions on a regular basis by patients helps ensure accuracy of results. In addition, because laboratory methods measure plasma glucose, most blood glucose monitors approved for home use and some test strips now calibrate blood glucose readings to plasma values. Plasma glucose values are 10–15% higher than whole blood glucose values, and it is crucial that people with diabetes know whether their monitor and strips provide whole blood or plasma results.

- Optimal use of SMBG requires proper interpretation of the data. Patients should be taught how to use the data to adjust nutrition, exercise, or pharmacological therapy to achieve specific glycemic goals. Health professionals should evaluate at regular intervals the patient's ability to use SMBG data to guide treatment. Although a number of SMBG methods store test results and with a computer interface can provide sophisticated analyses of blood glucose data. It is not known whether use of these data management systems yields better glucose control than patient review of results recorded in a logbook.

2.4.4 Cigarette smoking

Cigarette smoking is the most important cause of preventable morbidity and mortality around the world. The prevalence of smoking in patients with diabetes is similar to that in the general population, but the health repercussions are more severe (Ford and Shilliday 2006; Haire-Joshu *et al.*, 1999). Cigarette smoking has been shown to increase the risk of cardiovascular disease (CVD) more in patients with diabetes than in those without, and CVD is responsible for 65% of deaths in patients with diabetes. Smoking also increases the risk of peripheral vascular disease and resultant amputations. In addition to increasing the risk of macrovascular disease in patients with diabetes, smoking cigarettes increases the risk of diseases such as nephropathy, retinopathy, and neuropathy (Ford and Shilliday, 2006; Haire-Joshu *et al.*, 1999).

Quitting smoking reduces the risk of mortality in patients with diabetes, but the risk of mortality is correlated with the duration of smoking. This underscores the importance of addressing the issue of smoking in all patients with diabetes. To reduce the burden of

illness from smoking, health professionals should discourage smoking (Chaturvedi *et al.*, 1997).

2.5 Management of Diabetes

Nutritional intake and modification of lifestyle are the cornerstones for treating Type 2 diabetes. It has been recognized that, in order to achieve satisfactory metabolic control, adoption of self-management skills (i.e. the learned ability to perform an act competently) by the person with diabetes are essential (WHO, 1998). The provision of effective, ongoing education and support is necessary to equip people with the knowledge, skills, attitudes and motivation to manage their diabetes effectively (DOH, 1995).

2.5.1 Treatment of diabetes

2.5.1.1 Conventional therapies

The general consensus on the treatment of type 2 diabetes is that change in lifestyle is the most important therapy option. Other options include physical exercise, weight control, nutrition therapy, oral glucose-lowering drugs and injections of insulin. These are the conventional diabetes therapies (Dey *et al.*, 2002). The main goal of diabetic treatment is to keep blood sugar level within normal range as much as possible. Completely normal level is difficulty to maintain, but the closer to the normal range they can be kept, the less likely that short-term or long-term complications will develop (Berkow *et al.*, 1997). There are two main conventional medications for diabetes, these are insulin and oral hypoglycaemic drugs.

2.5.1.1.1 Insulin replacement therapy

This is used for patients who are not able to produce adequate amount of insulin eg. Type 1 diabetic and for those type 2 diabetics whose ability to produce insulin is extremely impaired. Insulin replacement can only be accomplished by injection because insulin is destroyed in the stomach, it can't be taken orally. Insulin is injected under the skin into the fat layer, usually in the arm, thigh or abdominal wall (Berkow *et al.*, 1997).

2.5.1.1.2 Oral Hypoglycaemic Drugs

There are about five classes of oral hypoglycemic agents for the treatment of Type 2 diabetes. The drug categories/classes include sulfonylureas, biguanides, alpha-glucosidase inhibitors, thiazolidinediones, and meglitinides. Sulfonylureas, which include the first generation (e.g., tolbutamide) and the second generation (e.g., glyburide) sulfonylureas, enhance insulin secretion from the pancreatic beta cells. Biguanides include the drug metformin, which was originally derived from a medicinal plant, *Galega officinalis*. Metformin reduces plasma glucose via inhibition of hepatic glucose production and increase of muscle glucose uptake. It also reduces plasma triglyceride and LDL-cholesterol levels. Alpha-glucosidase inhibitors include the drug acarbose. This drug category decreases postprandial glucose levels by interfering with carbohydrate digestion and delaying gastrointestinal absorption of glucose (Dey *et al.*, 2002).

Thiazolidinediones are represented by the drugs troglitazone, rosiglitazone and pioglitazone. These oral agents work by improving insulin sensitivity in muscle and to a much lesser extent, the liver. These drugs decrease plasma triglyceride levels, but such decrease may be associated with weight gain and an increase in LDL-cholesterol levels.

Meglitinides (drug name Repaglinide) augment insulin secretion, but weight gain, gastrointestinal disturbances, and hypoglycaemia are possible side effects (Dey *et al.*, 2002). The classes of hypoglycaemic medicine mentioned have some side effects as summarized in Table 1.

Table 1: Limitations of hypoglycaemic medications

Anti-diabetic drugs	Limitations/Side Effects
Sulfonylureas	Hypoglycaemia, weight gain
Biguanides	Gastrointestinal disturbances
Alpha-glucosidase Inhibitors	Gastrointestinal disturbances
Thiazolidinediones	Liver toxicity, weight gain, high LDL cholesterol, high cost
Meglitinides	Hypoglycaemia, weight gain
Insulin	Hypoglycaemia, weight gain

Source: Dey *et al.*, (2002).

2.5.1.2 Alternative therapies

Alternative therapies with antihyperglycemic effects are increasingly sought by patients with diabetes. Alternative treatments have been widely used in chronic diseases. Herbal medications are the most commonly used alternative therapy for controlling blood sugar, however, their safety and efficacy need to be further evaluated by well-designed, controlled clinical studies. Since various non-standardized forms of the herbs have been used as testing material, the results have been difficult to replicate. Therefore, preparation of standardized medicinal herbs is urgently needed in future studies and therapies. Although herbs used for diabetes are less likely to have the drawbacks of conventional drugs, potential adverse herb-drug interactions should be considered especially for patients receiving other conventional antidiabetic medications (Dey *et al.*, 2002).

2.5.2 Initial evaluation before medications

A complete medical evaluation should be performed to classify the patient, detect the presence or absence of diabetes complications, assist in formulating a management plan, and provide a basis for continuing care. If the diagnosis of diabetes has already been made, the evaluation should review the previous treatment and the past and present degrees of glycemic control (ADA, 2006b).

2.5.3 Management of diabetic care

People with diabetes should receive medical care from a physician-coordinated team. Such teams may include, but are not limited to, physicians, nurse practitioners, physician's assistants, nurses, dieticians, pharmacists, and mental health professionals with expertise and interest in diabetes. It is essential in this collaborative and integrated team approach that, individuals with diabetes assume an active role in their care. The management plan should be formulated as an individualized therapeutic alliance among the patient and family, the physician, and other members of the health care team. Any plan should recognize diabetes self-management education (DSME) as an integral component of care. In developing the plan, consideration should be given to the patient's age, school or work schedule and conditions, physical activity, eating patterns, social situation and personality, cultural factors, and presence of complications of diabetes or other medical conditions. A variety of strategies and techniques should be used to provide adequate education and development of problem-solving skills in the various aspects of diabetes management. Implementation of the management plan requires that each aspect is understood and agreed upon by the patient and the care providers and that the goals and treatment plan are reasonable (ADA, 2006b). Summary of cut off points of some of body parameters that need to be achieved by people with diabetes is given in Table 2. The correlations of

various units of blood glucose level are given in Table 3 to enable the reader to understand and compare blood glucose levels given in different unit

Table 2: Summary of recommendations for adults with diabetes

A1C (Glycated haemoglobin level)	< 7.0%*
Preprandial capillary plasma glucose	90-130 mg/dl (5.0-7.2 mmol/l
Peak postprandial capillary plasma glucose†	< 180 mg/dl (<10.0 mmol/l)
Blood pressure	< 130/80 mmHg
Lipids‡	
LDL	< 100 mg/dl (2.6 mmol/l)
Triglycerides	< 150 mg/dl (1.7 mmol/l)
HDL	> 40 mg/l (1.1 mmol/l)
Key concepts in setting glycemic goals:	
• A1C is the primary target for glycemic control • Goals should be individualized • Certain populations (children, pregnant women, and elderly) require special considerations • More stringent glycemic goals (i.e., a normal A1C, <6%) may further reduce complications at the cost of increased risk of hypoglycaemia • Less intensive glycemic goals may be indicated in patients with severe or frequent hypoglycaemia • Postprandial glucose may be targeted if A1C goals are not met despite reaching preprandial glucose goals	

*Referenced to a nondiabetic range of 4.0–6.0% using a DCCT-based assay. †Postprandial glucose measurements should be made 1–2 h after the beginning of the meal, generally peak levels in patients with diabetes.

‡Current NCEP/ATP III guidelines suggest that in patients with triglycerides ≥200 mg/dl, the “non-HDL cholesterol” (total cholesterol minus HDL) be utilized. The goal is ≤130 mg/dl.

§For women, it has been suggested that the HDL goal be increased by 10 mg/dl.

Source: ADA (2006b).

2.5.1.3 Hypoglycaemia

Changes in food intake, physical activity, and medication(s) can contribute to the development of hypoglycaemia. Hypoglycaemia, especially in insulin treated patients, is the leading limiting factor in the glycemic management of Type 1 and Type 2 diabetes. Hypoglycaemia cause symptoms similar to those of anxiety attack including sweating,

palpitations, and sometimes hunger. More severe hypoglycaemia reduces the glucose supply to the brain causing dizziness, confusion, fatigue, weakness, headaches, inappropriate behaviour that can be mistaken for drunkenness, inability to concentrate, vision abnormalities, epilepsy like seizure and coma. Prolonged hypoglycaemia may permanently damage the brain. Treatment of hypoglycaemia (plasma glucose <70 mg/dl) requires ingestion of glucose or carbohydrate-containing foods. Although pure glucose may be the preferred treatment, any form of carbohydrate that contains glucose will raise blood glucose (Berkow *et al.,* 1997; ADA, 2006b)

Table 3: Correlation between A1C level and mean plasma glucose levels on multiple testing over 2–3 months.

	Mean plasma glucose	
A1C (%)	**mg/dl**	**mmol/l**
6	135	7.5
7	170	9.5
8	205	11.5
9	240	13.5
10	275	15.5
11	310	17.5
12	345	19.5

Source: ADA (2006b).

Recommendations for treatment of hypoglycaemia

- Glucose (15–20 g) is the preferred treatment for hypoglycaemia, although any form of carbohydrate that contains glucose may be used, and treatment effects should be apparent in 15 min;
- Treatment effects on hypoglycaemia may only be temporarily corrected. Therefore, plasma glucose should be tested again in ~15 min as additional treatment may be necessary;
- Glucagon should be prescribed for all patients at significant risk of severe hypoglycaemia and does not require a health care professional for its administration;

2.6 Diabetic self-care

Effective care lies almost entirely in the hands of the patient, who lives with the condition. However, a health professional centered approach based on the medical model is traditionally used. This model of care may neglect the psychosocial and emotional aspects of the disease and could be one of the main reasons why only 7% of adults with diabetes manage to follow all the steps recommended by practitioners including dietary modification, physical activity regime, and compliance with medication and monitoring blood glucose (Griffin, 1998). This finding was also supported by a study done by Saydah *et al.,* (2004) in the United States of America which showed that, only 7.3% of adults with diabetes achieved the recommended goal for their diabetic control. In DAWN (2005) study it was reported that, adherence with recommendations for diet, physical exercise, medication, glucose testing, and keeping appointment was low. Fewer than one in five people with diabetes (19.4% of those with type 1 diabetes and 16.2% of those with type 2 diabetes) reported to have completely complied with all aspects of their prescribed regimens. Providers rated adherence substantially worse than did people with diabetes (7.3% of providers estimated that their typical type 1 patients completely complied with all aspects of their prescribed regimens, and 2.9% of providers estimated the same for their typical type 2 patients).

2.7.1 Psychosocial distress

Distress is an unpleasant emotional, psychological, social, or spiritual experience that interferes with the patient's ability to cope with the disease treatment. The concept can be conceptualised as existing along a continuum with low levels of distress at one end (e.g., feelings of vulnerability, sadness, and fears emerging from a disease or life event) to high

levels of distress that are disabling (e.g., clinical depression, panic, anxiety and spiritual crisis). Distress can occur when a person feels that he or she does not have the resources to manage or control the disease. Distress experienced by patients who have the same diagnosis and are undergoing the same treatment may be very different (Quade, 2005).

Diabetes is a demanding disease with a major effect on the quality of life of patients and their families (Cox and Gonder-Frederick, 1992). Research has shown that, psychosocial distress frequently occurs in people with diabetes and is often related to difficulties in coping with the daily regimen and worries about developing late complications (Rubin and Peyrot, 1992; Gafvels *et al.,* 1993). Psychosocial distress is not only burdensome itself, but it can also impede the self-care practices and behaviours of the patients, thereby compromising glycemic control (Mazze *et al.,* 1984; Aikens *et al.,* 1992; Metsch *et al.,* 1995). Efforts are therefore required to help those people with diabetes to reduce their psychosocial distress and improve their glycemic control through good self care practices. This will in turn improve their quality of life and increase survival.

CHAPTER THREE

3.0 MATERIAL AND METHODS

3.1 Study Design

A cross sectional survey was conducted to determine self-care practices and psychosocial distress among people with type 2 diabetes mellitus in Dar es Salaam, Tanzania.

3.2 Study Area and Duration

This study was done in Dar es Salaam. It involved three hospitals, Muhimbili National Hospital, Temeke Municipal Hospital and Ilala (Amana) Municipal Hospital. Kinondoni (Mwananyamala) Municipal Hospital was used as a pilot study area. According to the population and housing Census (Tanzania Bureau of Statistics, 2002) Dar es Salaam has a population of 2,497,940 with 1,261,077 being males and 1,236,863 being females. Using the diabetic prevalence of 4% in urban area (Ramaiya, 2005), Dar es Salaam was estimated to have 99,917 people with diabetes.

3.3 Study Population

Patients with type 2 diabetes mellitus attending the Muhimbili, Amana and Temeke Hospital diabetic clinics were qualified to participate in the study.

Inclusion criteria

Men and women with Type 2 diabetes mellitus were included in the study.

Exclusion criteria

Patients with Type 1 diabetes mellitus, who were below the age of 40 years when their diabetes was diagnosed and required insulin therapy at the time of diagnosis (Welborn *et al.,* 1983). Pregnant women were also excluded from the study.

3.4 Sampling Technique

Systematic random sampling was used in which the principal investigator serially selected every patient with Type 2 diabetes mellitus attending the respective clinics until the numbers of subjects desired in each clinic were achieved.

3.5 Sample Size

The sample size was calculated using statistical power estimate by Griffin (1998), Saydah *et al.,* (2004), DAWN study (2005), that only about 7% of adults with diabetes manage to follow all the steps deemed by practitioners to be necessary for optimal management and good glycaemic control, including dietary modification, physical activity regime, and compliance with medication and monitoring blood glucose.

Since there was no any study reported in Tanzania showing the proportion of diabetics who followed their diabetic recommendation optimally, the 7% percent reported in other studies was taken as the estimate for Tanzania. It was assumed that, since Tanzania is a poor country, it was less likely to exceed the estimate obtained from developed countries.

The following formula was used to determine the sample size: $n= z^2pq/d^2$

Where by:

n= the desired sample size

z= the standard normal deviate (in this study it was 1.96 that corresponded to 95% CI).

p= the proportion in the target population with certain characteristics (in this study was 0.07) (Griffin 1998), Saydah *et al.,* (2004), DAWN study (2005).

q = 1.0 – p

d = degree of accuracy desired (in this study was 0.05).

$n = 1.96^2 \times 0.07(1.0 - 0.07)/0.05^2$

n = 100

To increase accuracy of the study 120, participants were taken. Patients attending the clinic and who met the inclusion criteria were selected, in which sixty (60) patients were from Muhimbili, and thirty (30) patients were selected from Temeke and Amana clinics, respectively.

3.6 Study Instruments for Data Collection

Instruments that were used in this study included, Problem Areas in Diabetes (PAID) scale, (Polonsky *et al.,* 1995; Welch *et al.,* 2003) and Summary of Diabetes Self Care Activities (SDSCA) measure, (Toobert *et al.,* 2000). Also, a demographic and nutritional characteristics questionnaire was developed, pre-tested and administered. Waist, hip and arm circumferences were taken from all participants. The study questionnaire comprised of PAID, SDSCA, demographic and nutritional characteristics tool (Appendix 1).

3.6.1 Summary of diabetes self-care activities (SDSCA) measure

The SDSCA measure was a brief questionnaire of diabetes self-care that included items assessing the following aspects of the diabetes regimen: general diet, specific diet, physical exercise, blood-glucose testing, foot-care, and smoking (Toobert *et al.*, 2000). The SDSCA is probably the most widely used instrument for measuring diabetes self-care in adults. Moreover, it is the measure that has been successfully adapted for adolescents with type 1 diabetes (Schafer *et al.,* 1983; Skinner and Hampson, 1998, 2000).

In this study, the revised version by Toobert *et al.,* (2000) was used. The revised SDSCA consists of a core set of 11 items that have all been used in previous studies along with the expanded list of 14 additional questions. The revised SDSCA version was used because of its consistency in mean values across studies, sufficient variability and lack of ceiling or floor effects, temporal stability, internal consistency, predictive validity, sensitivity to change, ease of scoring, and ease of interpretation.

The revised version also contained items on foot-care adapted from Litzelman *et al.,* (1993), which was an important aspect of the diabetes regimen that was not included in the original SDSCA. It also includes items on cigarette smoking. Although not usually viewed as part of the diabetes regimen, given the greatly increased risk of cardiovascular diseases among diabetes patients who smoke (Haire-Joshu, 1999), it was important to know a patient's smoking status so that appropriate advice could be given.

Modification was made on the SDSCA for items, which were supposed to measure blood glucose testing practices for the patients because it could not match with our practices in Tanzania. No much emphasis was placed in blood glucose self-test because most patients were poor and could not afford the procedure. So instead of patients to be asked ''on how many of the last SEVEN DAYS did you test your blood glucose''? They were instead asked ''Have you ever tested your blood glucose since the last time you visited the diabetic clinic''? And if yes, how many times did you test and why? Some few additional questions were asked on the frequency of eating fruit and vegetables per day; the reason of not using medication as advised; and obstacles for self care and recommendation for improvement of diabetes care.

SDSCA scoring

Scores were calculated for six regimen areas that were diet, physical exercises, medication, blood- glucose testing, foot-care and smoking.

Scoring the scales

General diet = Mean number of days for items C1.1 and C1.2; C1.1: = How many of the last SEVEN DAYS have you followed a healthful eating plan? C1.2: = On average, over the past month, how many DAYS PER WEEK have you followed your eating plan?

Specific diet = Mean number of days for items C1.3 and C1.4, reversing item C1.4 (0=7, 1=6, 2=5, 3=4, 4=3, 5=2, 6=1, 7=0). C1.3: = On how many of the last SEVEN DAYS did you eat five or more servings of fruits and vegetables? And C1.4: = How many of the last SEVEN DAYS did you eat high fat foods such as red meat or full-fat dairy products?

Physical exercise = Mean number of days for item C2.1 and C2.2; C2.1: = On how many of the last SEVEN DAYS did you participate in at least 30 minutes of physical activity? (Total minutes of continuous activity, including walking) and C2.2: = On how many of the last SEVEN DAYS did you participate in a specific exercise session (such as swimming, walking, biking) other than what you do around the house or as part of your work?

Foot care = Mean number of days for item C4.1 and C4.2**;** C4.1: = On how many of the last SEVEN DAYS did you check your feet? And C4.2: On how many of the last SEVEN DAYS did you inspect the inside of your shoes?

Given the low inter item correlation for this scale, using individual items is recommended (Toobert *et al,* 2000). Due to low level of inter item correlation the presentation of findings from this scale was done using both combined items and individual items. The full ranges of item are found in Appendix 1.

3.6.2 Problem areas in diabetes (PAID) scale

The PAID is a measure of diabetes specific psychosocial emotional distress. It was developed by the Joslin Diabetic Center, Boston USA (Polonsky *et al;* 1995) (Appendix 1). PAID has been shown to have high internal reliability (Cronbach alpha = 0.90) and 2-month test–retest reliability using a sample of stable patients (r = 0.83), and to correlate strongly with a wide range of theoretically related constructs.

The PAID questionnaire comprises 20 questions that cover a range of emotional states frequently reported in Type 1 and Type 2 diabetes. The PAID produces scores ranging from 0 to 100, whereby higher scores indicate greater emotional distress. The PAID uses a 5-point item scaling: 'Not a problem = 0', 'Minor problem = 1', 'Moderate problem = 2', Somewhat serious problem = 3', and 'Serious problem = 4'. The 0–100 total score is achieved by summing the 0–4 responses given for the 20 PAID items and multiplying this sum by 1.25 (Welch *et al.,* 2003). PAID scores have been found to show positive associations with blood glucose level and are a major predictor of adherence to treatment. The PAID seems to be a good candidate for the measurement of diabetes-related distress across countries, and it has shown a cross-cultural validity (Snoek *et al.,* 2000).

3.6.3 Translation of tools

The PAID and SDSCA tools were translated into Kiswahili. Back translation to English was done by a an independent researcher from School of Nursing of the Muhimbili

University College of Health Sciences Tanzania, to check if there was a substantial difference between the two versions. No substantial differences were noted, and after corrections the Kiswahili versions of the questionnaires were adopted.

3.7 Pilot Study

A pilot study was conducted in Mwananyamala hospital in which 12 Type 2 diabetic patients were involved. The patients involved in pilot study were having similar characteristics as the studied patients. After the pilot study, some minor modifications were made to the PAID items to make them clear to the respondents. During pilot study, PAID had an internal consistency of items of 0.94 Cronbach's alpha which showed that, the tool was reliable, while SDSCA had an internal consistency items of 0.8 Cronbach's alpha which showed that, the tool was reliable. The results of the pilot study were used in perfecting the Kiswahili version of the two scales before they were used.

3.8 Data Collection

Data were collected by the Principal Investigator and two trained Research Assistants. The research assistants were trained by the principal investigator on how to use the tools and also were involved in the pilot study. The principal investigator and research assistants worked together with the in-charge of the diabetic clinics of the respective hospitals in recruiting research subjects. After recruitment, the candidates were told the purpose of the study and all the necessary information about the research. Thereafter, they were requested to sign the consent form if they were willing to participate in the study. The content of the consent form was in Kiswahili so that all participants could know what they were signing.

Patients, who agreed to participate, were interviewed by the researchers following the questions on demographic and health characteristics questionnaire, Summary of Diabetes Self-care Activities (SDSCA) measure and Problem Areas in Diabetes (PAID) scale (Appedix 1). The researcher recorded the responses on the questionnaires. Also, a recent level of fasting blood glucose level was recorded from patient record. Measurements of body parameters including weight, height, waist, hip and arm circumferences and blood pressure were made and recorded.

3.8.1 Measurement of anthropometric indices

Waist circumference

The respondent was requested to stand with their stomach relaxed. Narrowest point at their waist was located and measured by using a tape measure and recorded in the nearest 0.1 cm

Hip circumference

While standing and relaxed the widest point of their hips and buttocks was measured and recorded in the nearest 0.1 centimetres.

Mid upper arm circumference

This circumference was taken at the mid point between the acromion and olecranon process of the scapular and the ulna, respectively. While the arm was relaxed, the circumference was measured and recorded in the nearest 0.1 cm.

3.9 Statistical Analysis

Data collected were coded and entered into the Statistical Package for Social Science (SPSS version 11.5). Before analysis the data were cleaned. Descriptive and inferential statistics were run to determine the significance of effect of self-care practices and distress

on changes of body indices eg. Body Mass Index (BMI); Waist Circumference (WC); Waist Hip Ratio (WHR); Fasting Blood Glucose Level (FBG); Blood Pressure (BP) and Mid-upper Arm Circumference (MUAC). All values were considered significant at $P < 0.05$.

3.10 Ethical Consideration

Ethical clearance for conducting the study was granted by the Muhimbili University College of Health Sciences (MUCHS). Informed consent and permission was sought from participating organizations and individuals.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 General Characteristics of the Study Population

This section describes the general characteristics of the study sample. These characteristics include age, sex, marital status, family size, occupation, income, family history of diabetes and the duration of living with diabetes. Also, biomedical indices of the study sample were described including, blood pressure, fasting blood glucose, weight and mid upper arm circumference. The characteristics of the study sample helped to find some association between different variables and the level of self-care and diabetic related distress measures.

4.1.1 Age and sex distribution

Out of 121 Type 2 diabetic patients involved in this study, 38.8% (n = 121) were males and 61.2% were females. Their mean age was 53.0 ± 10.9 years ranging from 27 - 88 years. Female participants happened to be significantly younger than their male counterparts ($X^2 = 15.0$, P = 0.001). Majority of the participants were between 41 and 60 years (Table 4). Almost all participants (87.6%, n = 121) were over the age of 40 years which was a typical age at which Type 2 diabetes mellitus occurs (Table 4). The mean age for females was 50.7 ± 10.5 years, ranging from 27 to 88 years and the mean age for males was 56.8 ± 10.5 years ranging from 39 to 82 years.

Table 4: Age and Sex distribution of the respondents

	Sex of the respondent (%)		
Age group (Years)	**Male (n = 47)**	**Female (n = 74)**	**Total (n = 121)**
20 - 40	4.4	17.6	12.4
41 - 60	57.4	71.6	66.1
61 and above	38.3	10.8	21.5
Total	**100**	**100**	**100**

(X^2 = 15.0, P = 0.001).

4.1.2.1 Marital status

People with Type 2 diabetes were mostly adults, so majority (71.1%, n = 121) of studied subjects were married; the remaining (16.5%, n = 121) were widowed, 8.3% (n = 121) were single, 3.3% (n = 121) were divorced and 0.8% (n = 121) were separated. There was significant association between sex of the diabetic individual with the marital status (X^2 = 13.2, df = 4, P = 0.01). Diabetic men were more likely to be married (89.4%, n = 47) than diabetic women (59.5%, n = 74). Also diabetic men were less likely to be widowed (8.5%, n = 47) than diabetic women (21.6%, n = 74).

4.1.2.2 Family size

Table 5 summarized the number of children living with the respondents including other dependants who shared the same pot. Almost all participants (95%, n = 121) admitted to have at least 1 child, while 5% (n = 121) had no children. When the participants were asked about the number of children who were dependants to the family, the average was 2.4 children ranging from 0 to 7 children. About 51.2% (n = 121) of the families had 1 to 2 children depending on them (Table 5).

Table 5: Number of children living with the respondents including dependants

Number of Children	Frequency	Percent
0	21	17.4
1-2	41	33.9
3-4	42	34.7
5-6	16	13.2
Above 7	1	0.8
Total	**121**	**100.0**

When respondents were asked about the number of people they lived with including themselves and their children, the average family size was 6.1 people, ranging from 1 to 20 people. The family size is an important aspect because it indicates the amount of resources required to take care of the family members. If the family is very big it reduces the ability of the respondent to take care of him/herself. Family members may also play a positive role in helping the patient to care for him/herself. It was observed in this study that, most families had few children depending on them (Table 5), however, the family sizes were generally big due to presence of other non-child dependants (Table 6). As shown in Table 6, 59.5% (n = 121) of the studied families had seven or more members.

Table 6: Number of people living in the family

Number of People	Frequency	Percent
1 - 2	12	9.9
3 - 4	26	21.5
5 - 6	34	28.1
7 and above	49	40.5
Total	**121**	**100.0**

4.1.3 Level of education

Education level is one of the important aspects in the care of people with chronic illnesses. It is important because people living with diabetes need change of lifestyles that requires some kind of mental capability to plan and follow strict plans including meals, physical exercises and medication. Effective self-care requires a great deal of self-commitment and ability to comprehend the consequences of not following the care regimen well. Half of the studied subjects had primary school education (51.2%, n = 121) while 19% (n = 121) had no formal education. The fact that 70.2% (n = 121) had primary and no formal education, the majority of the respondents could be categorized as having low education level (Table 7). There was no significant different in the level of education between male and female participants ($X^2 = 8.2$, df = 4, P = 0.08).

Table 7: Education level attained by the respondents

Education level	Frequency	Percent
No formal education	23	19.0
Primary education	62	51.2
Secondary education	25	20.7
Post Secondary or Vocational	9	7.4
University	2	1.7
Total	**121**	**100.0**

4.1.4 Occupation and perception of income adequacy

4.1.4.1 Occupation

Occupation influences income, the level of self-care and the level of diabetic related distress. In the study sample, 22.3% (n = 121) of respondents were wage employed, 21.5% (n = 121) were doing petty business, while the rest were involved in diverse occupations ranging from housewives (17.3%, n = 121) to dependants (5.8%, n = 121)(Table 8).

Epidemiological studies have shown that, health outcomes can be related to occupational status. Individuals in executive positions have better health outcomes than white-collar workers, who in turn fair better than blue-collar workers. Examinations of some of the factors involved in Social Economic Position (SEP) indicated that, job stress is related to health outcomes. Other factors such as gender, may complicate the issue. For example, marital stress, but not work stress, appears to predict poor prognosis in working-age women with CHD, whereas for men, it is work stress, but not marital stress, that is associated with poor prognosis (Orth-Gome´r et *al.,* 2000).

Table 8: Occupation of the respondents

Occupation	**Frequency**	**Percent**
Wage employment	27	22.3
Self employed	10	8.3
Petty business	26	21.5
Business	8	6.6
Agriculture	12	9.9
House wife	21	17.3
Dependant	7	5.8
Retired	10	8.3
Total	**121**	**100.0**

4.1.4.2 Perception of income adequacy

When the respondents were asked whether their incomes were adequate, only 21.5% (n = 121) rated their incomes as adequate, 57.0% (n = 121) rated their income as barely enough, while 21.5% (n = 121) rated their incomes as totally inadequate (Figure 2). These results indicated that, majority of the respondents in the study had low or modest incomes. Perception about adequacy of incomes between male and female was not significantly different ($X^2 = 0.92$, df = 2, p = 0.62).

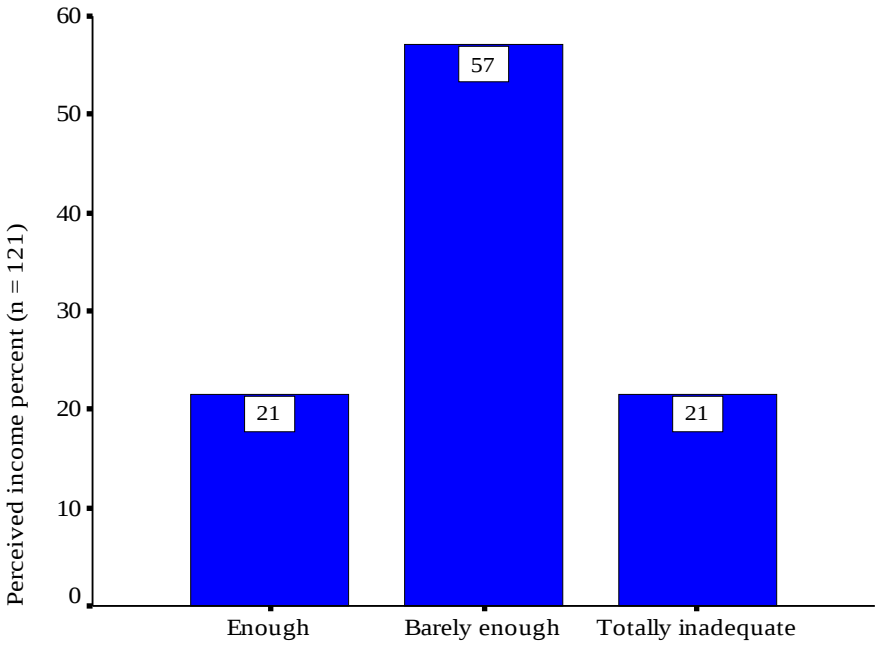

Figure 2: Perception of income adequacy by the respondents

It was observed in this study that, people with perceived higher income scored higher in general and specific diet related practices but the scores for foot-care and physical exercises were almost the same as those of low-income bracket. In case of diabetic related emotional distress (PAID), the respondents with higher income had significantly lower diabetic related distress (t = -2.376, p = 0.019) than those with low incomes (Table 9).

Table 9: Perceived income, self care practice and diabetic related distress score (PAID)

Category	Perceived level of income			
	Enough (n = 26)	Not enough (n = 95)	t	P value
General Diet	5.37 ± 2.20	4.38 ± 2.46	1.848	0.067
Specific Diet	4.08 ± 1.62	3.64 ± 1.53	1.287	0.201
Exercise	3.33 ± 2.08	3.48 ± 1.76	-0.375	0.708
Foot Care	4.86 ± 1.53	4.98 ± 1.50	-0.377	0.707
PAID	16.06 ± 15.78	24.78 ± 16.78	-2.376	0.019

4.1.5 Family history and duration of living with diabetes

4.1.5.1 Family history

Insulin resistance develops because of the combined effects of genetic susceptibility and environmental or lifestyle factors. For example, insulin sensitivity may be reduced as a result of alterations in any of the genes coding for a protein in the insulin-signalling pathway and/or factors that lead to elevated levels of circulating factors that interfere with components of the insulin signalling pathway (Lebovitz, 2001). It is well known that, people with a family history of Type 2 diabetes are more likely to be insulin resistant than those without a family history. Those from families with history of diabetes are more likely to get the disease, especially if they did not take extra measure to avoid risk factors, such as sedentary life-style that may lead to obesity. It was observed in the study sample that, about half of the subjects (47.9%, n = 121) had family history of diabetes, while 52.1% (n = 121) reported to have no family history of diabetes.

4.1.5.2 Duration of living with diabetes

The average duration of living with diabetes in the study sample was 6.1 ± 7.1 years, ranging from 0.03 to 54 years. Majority (61%, n = 121) of the patients had lived with the disease for 0 - 5 years, while 24% (n = 121) had lived with the disease for 6 to 10 years (Figure 3). A temporal trend in diabetes is important because it determines changes in various body parameters and psychosocial related changes. For example Leibson et al. (2001), demonstrated that, the prevalence of obesity and extreme obesity among individuals at the time they first meet the criteria for diabetes has been increasing over time. This means that, the use of drugs and other diabetic management aspects by diabetic

patients led to increase in their weight over time, increasing their risk of morbidity and mortality.

In order to determine how the duration of living with diabetes affects the care and distress level, the respondents were divided into two groups based on duration of living with diabetes; 0 - 5 years and 6 years and above. The two groups were compared using paired t-test on their level of self-care (days per week), fasting blood glucose (mmol/l) and diabetic related emotional distress. The results showed that, those who lived with diabetes for 5 years or less had slightly higher score in general diet, specific diet and physical exercises while those who lived with diabetes mellitus for six years and above scored better in foot-care (Table 10). Those with 0 - 5 years duration had significantly ($p < 0.05$) lower level of fasting blood glucose compared to those with duration ≥ 6 years. Since the level of blood glucose is associated with increased risk of complications (WHO 2003; Fong et al., 2004) this implied that, those with less years of living with diabetes were less likely to have cormobidity and thus were more active in production and could take care of themselves. The levels of diabetic related emotional distress tend to decrease with the increase in duration of living with diabetes, since the patients get used to the disease as time goes. This phenomenon was also shown in this study, although the difference in the level of distress was insignificant ($p < 0.05$).

Table 10: Level of self-care practice, diabetic related distress score (PAID) and fasting blood glucose

Category	0-5 Yrs (n = 74)	≥ 6 Yrs (n = 47)	t	P value
General Diet	4.80 ± 2.52	4.26 ± 2.29	1.21	0.229
Specific Diet	3.76 ± 1.44	3.69 ± 1.72	0.225	0.822
Exercise	3.45 ± 1.93	3.43 ± 1.66	0.048	0.962
Foot Care	4.88 ± 1.44	5.09 ± 1.59	-0.727	0.469
FBG	10.42 ± 5.52	12.61 ± 5.33	-2.171	0.032
PAID	23.38 ± 16.55	22.15 ± 17.59	0.387	0.699

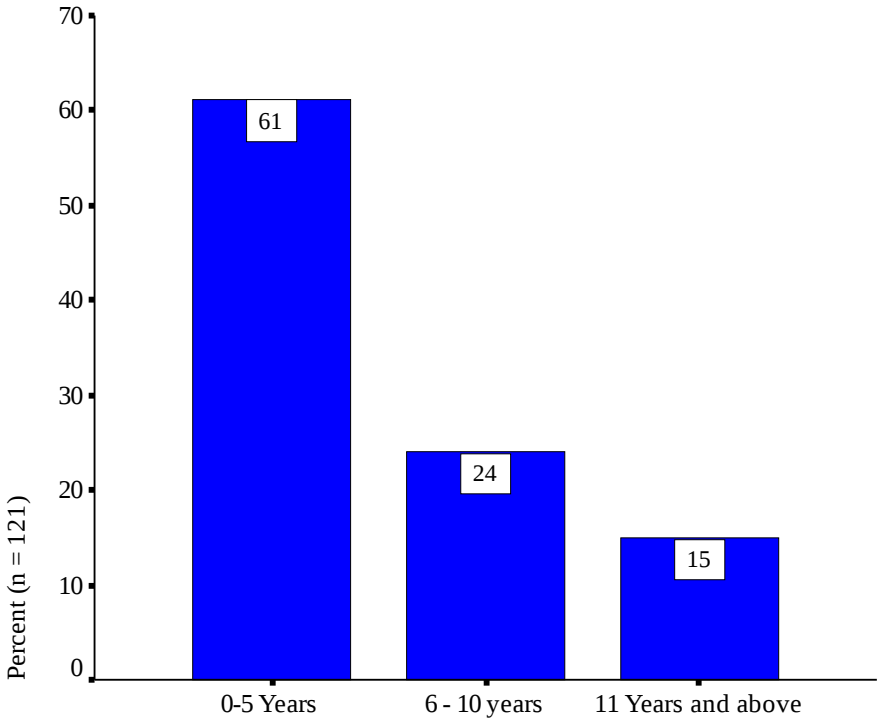

Figure 3: Duration patients lived with diabetes

4.2 Predictors of Glycemic Control

A linear multiple regression model was built to check the predictors of glycemic control into which fasting blood glucose was taken as a dependent variable. Categorical variables such as marital status, level of education, perceived income, occupation and gender was changed to dummy variables before used to the model. The model was significant ($p = 0.001$) and was able to explain 33.6% of the variation in the fasting blood glucose (Table 11). Younger age, lower BMI, increased duration of diabetes were significant predictors of worse glycemic control, while increased PAID score was predictor of worse glycemic control but the prediction was not significant. This observation complied with findings by Nichols *et al.* (2000) who reported that, younger age, lower BMI, increased PAID score and increased duration of diabetes were predictors of worse glycemic control. Also, low score in general diet was significant predictor of worse glycemic control while specific diet and physical exercise predicted worse glycemic control but not significantly. This observation underline the fact that, although there are many factors which influence glycemic control (eg. genetics, physiology, and quality of medical care), good self-care is a critical aspect for successful control of blood glucose (Heisler *et al.*, 2003).

In case of categorical variables, having primary education was a predictor of low glcemic level compared to other category of education. Other categorical variable like marital status, level of education except primary, perceived income, occupation and gender was not able to significantly predict glycemic control

Increase of score in foot-care was found to slightly predict worse glycemic control although the prediction was not significant (p = 0.798). Diabetic patients with worse glycemic control are more likely to suffer from periphery neuropathy especially in the feet which is characterized by burning pain, electrical or stabbing sensations, parasthesiae, hyperaesthesia, and deep aching pain. These symptoms lead diabetic patients to increase their foot-care and this may explain why high score in foot-care predicts worse glycemic control.

4.3. Biomedical Characteristics

4.3.1 Fasting blood glucose

The average fasting blood glucose of the respondents was 11.2 ± 5.5 mmol/l (range 2.7 to 27.8 mmol/l). Females had slightly higher mean fasting blood glucose (11.34 mmol/l) compared to males (11.16 mmol/l) but the difference was insignificant, (t = -0.170; df 119; p = 0.865). The average level of fasting blood glucose was above the minimum recommended level (7.8 mmol/l) for reducing diabetic related complications (UKPDS, 1995). As shown in Table 12, only 34.7% (n = 121) of the respondents had desired fasting blood glucose, 42.1% (n = 121) had modestly elevated fasting blood glucose while 23.0% (n =121) had very high levels of fasting blood glucose (Table 12). These findings were comparable with those observed in other studies (Harris *et al.*, 1999). Clement (1995) reported that, ideal glycemic control is reached by less than half of people with Type 2 diabetes mellitus possibly due to the fact that, about 50 - 80% of people with diabetes lack the knowledge and skills in diabetes care.

4.3.2 Blood pressure (BP)

Blood pressure (BP) is another biomedical indicator that is important in the management of diabetic patients. In this study, the mean systolic blood pressure of the respondents was 134.7 ± 22.8 mmHg while the average diastolic pressure was 86.1 ± 13.9 mmHg (Table

13). The United States Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure defined essential hypertension as a blood pressure above 140/90 mmHg (Bloomgarden, 2001). The average blood pressure (134.7/86.1 mmHg) observed in this study was slightly below the cut off point for essential hypertension. The mean systolic and diastolic blood pressure for females was slightly higher than that for males but the difference was not significant, ($t = -0.986$, $p = 0.326$ for systolic blood pressure and $t = -1.876$, $p = 0.063$, for diastolic blood pressure).

Table 11: Standardized β coefficients and level of significance of predictors of glycemic control (blood glucose) for people with type 2 diabetes

Predictor	Standardized coefficients Beta	t	P-value
(Constant)		6.918	0.000
Age of the respondent in years	-0.285	-2.604	0.011
Duration of living with diabetes in years	0.241	2.678	0.009
Respondent BMI	-0.343	-3.759	0.000
General Diet	-0.220	-2.366	0.020
Specific diet	-0.092	-1.041	0.300
Exercise	-0.011	-0.122	0.903
Foot Care	0.024	0.257	0.798
PAID Score	0.133	1.419	0.159
Perceived income (enough)	0.122	1.350	0.180
Sex of respondent (Male)	-0.032	-0.309	0.758
Married	-0.036	-0.300	0.765
Single	-0.112	-0.938	0.350
Divorced and Separated	-0.030	-0.305	0.761
No formal education	-0.050	-0.403	0.688
Primary education	-0.258	-2.202	0.030
Post secondary and University	-0.122	-1.148	0.254
Wage employment	0.040	0.395	0.693
Petty business	0.050	0.475	0.636
Business	-0.079	-0.798	0.427
Agriculture	0.024	0.256	0.799

Dependent Variable: Fasting blood glucose

Table 12: Levels of fasting blood glucose (FBG) among respondents

FBG Level	Frequency	Percent	Inference
2.5-7.8 mmol/l	42	34.7	Normal
7.9-15 mmol/l	51	42.1	Elevated
15.1mmol/l and above	28	23.1	Very high
Total	**121**	**100.0**	

Table 13: Distribution of blood pressure among males and females

Blood pressure (mmHg)	Sex of the respondent	n	Mean	Std. Deviation	Std. Error Mean
Systolic Blood Pressure	Male	47	132.21	23.25	3.39
	Female	74	136.41	22.62	2.63
Diastolic Blood Pressure	Male	47	83.23	11.14	1.625
	Female	74	88.05	15.20	1.767

4.3.3.1 Waist circumference (WC)

4.3.3 Waist and hip circumferences

According to National Institutes of Health (NIH)(Janssen *et al.*, 2004) males and females with waist circumference ≤ 102 cm and ≤ 88 cm, respectively are considered to be normal, whereas males and females with waist circumference > 102 cm and > 88 cm, respectively are considered to be above normal. The average waist circumference for males in this study sample was 92.0 ± 10.0 cm while for females the mean waist circumference was 96.2 ± 12.1 cm. The average male waist circumference was below the recommended 102 cm, while for females it was significantly above the recommendation (88 cm)($t = 5.837$, $df = 73$, $p = 0.000$). In the study population, 85.1% (n = 47) of males had normal waist circumference while only 21.6 % (n = 74) of females had normal waist circumference (Table 14).

Table 14: Waist circumference for males and females with Type 2 diabetes

Sex	Circumference (cm)	Frequency	Percent	Inference
Men	≤ 102 (89.1 ± 7.6)	40	85.1(n = 47)	Normal
Female	≤ 88 (78.6 ± 6.7)	16	21.6 (n = 74)	Normal
Men	> 102 (108.9 ± 3.1)	7	14.9 (n = 47)	Above normal
Female	> 88 (101.1 ± 8.0)	58	78.4 (n = 74)	Above normal

4.3.3.2 Hip circumference and waist-hip circumference ratio

The average hip circumference for males was 99.4 ± 9.6 cm and for females was 105.2 ± 11.9 cm. The average waist-hip circumference ratio for males was 0.92 ± 0.056 and for female was 0.91 ± 0.06. According to Emporia State University website (http://www.emporia.edu/), (visited on May 31, 2006) the risks associated with W:H ratio is as classified in Table 15.

Table 15: Classification of risks for non-communicable diseases associated with W:H ratio

Classification	Men	Women
High Risk	>1.0	>0.85
Moderately High Risk	0.90-1.0	0.80-.85
Lower Risk	<0.90	<0.80

Source: (http://www.emporia.edu/)

Based on the W:H ratio risk classification in Table 15, females in the study sample were at a higher risk for cardiovascular diseases (CVD) compared to males (Table 16).

Table 16: Waist hip ratio and risk of chronic diseases for male and females

Sex	W:H Ratio		Frequency	Percent	Inference
Men	<0.90	(0.87 ± 0.026)	18	38.3 (n = 47)	Lower Risk
Female	<0.80	(0.77 ± 0.023)	4	5.4 (n = 74)	Lower Risk
Men	0.90-1.0	(0.95 ± 0.021)	25	53.2 (n = 47)	Moderately High Risk
Female	0.80-.85	(0.83 ± 0.014)	8	10.8 (n = 74)	Moderately High Risk
Men	>1.0	(1.05 ± 0.039)	4	8.5 (n = 47)	High Risk
Female	>0.85	(0.94 ± 0.049)	62	83.8 (n = 74)	High Risk

4.3.4 Weight, height and body mass index

Height and weight of the respondents were recorded and used to calculate the respondents' BMI. The BMI (kg/m^2) was categorized according to Leibson *et al.* (2001) whereby BMI <18.5 = underweight; 18.5 – 24.9 = normal weight; 25.0 – 29.9 = overweight; 30.0 – 39.9 = obese and ≥ 40 = extremely obese. The mean weight of the respondents was 66.4 ± 12.6 kg (range 35.0 to 99.5 kg), while the mean height of the respondents was 159.2 ± 8.3 cm (range 135 to 184.5 cm). The mean BMI of the respondents was 26.2 ± 4.9 kg/m^2 (range 15.4 to 39.1 kg/m^2).

The average BMI for the females (27.0 ± 5.1 kg/m^2) was significantly higher ($t = -2.177$, $p = 0.031$) than that of males (25.0 ± 4.3 kg/m^2). The classification of the BMI for the study sample is summarized in Table 17. The classification of BMI for males showed that, about half (48.9%, n = 47) of participating males had normal BMI and only 12.8% (n = 47) were obese (Figure 4). Only 28.4% (n = 74) of females had normal BMI while majority 66% (n = 74) were overweight and obese (Figure 4).

Since obesity is a well recognized determinant of many non-communicable diseases such as diabetes mellitus, coronary heart diseases (CHD) and stroke (WHO, 1998), our study sample was in a high risk of CHD and stroke since only 28.4% and 48.9% of females and males respectively had normal BMI.

Table 17: BMI distribution of the study sample

BMI Range (kg/m^2)	Inference	Frequency	Percent
<18.5	Underweight	6	5.0
18.5 – 24.9	Normal	44	36.4
25.0 – 29.9	Overweight	45	37.2
30.0 – 39.9	Obese	26	21.5
	Total	**121**	**100.0**

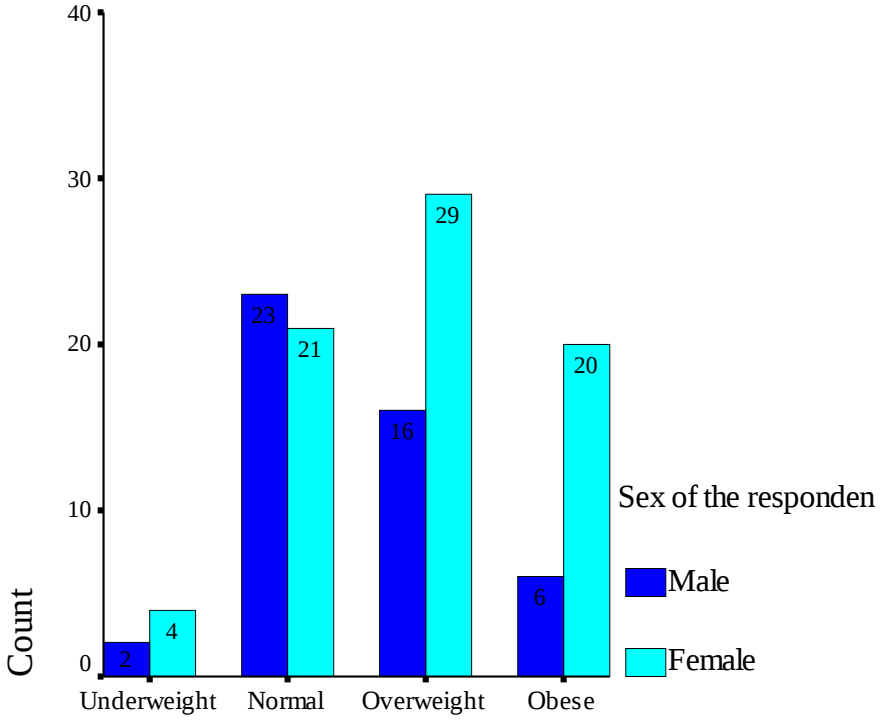

Figure 4: BMI distribution for males and females

4.3.5 Mid upper arm circumference

Mid-upper arm circumference (MUAC) was used to determine the level of under-nutrition (muscle mass) for people with diabetes. This measure is widely used in disaster areas especially to identify people who would need nutrition rehabilitation. The Helpage International classification (HelpAge International, 2000) was used for categorization, whereby subjects with MUAC above 24.0 cm were classified as normal; 23.1 – 24.0 cm = mild undernutrition; 22.1 – 23.0 cm = moderate undernutrition; and below 22.1 cm = severe undernutrition. The average MUAC for the study sample was 29.7 ± 4.0 cm (range 21.0 to 41.0 cm) (Table 18). The average MUAC for the females (30.2 ± 4.2 cm) was significantly higher (t = -1.997, p = 0.048.) than that for males (28.8 ± 3.5 cm). The MUAC classification as provided by Helpage International helped to identify undernourished and not over nourished subjects (Table 18).

Table 18: MUAC classification and distribution on the study sample

MUAC (cm)	Inference	Male % (n = 47)	Female % (n = 74)	Total % (n = 121)
Below 22.1	Severe undernutrition	8.5	6.8	7.4
22.1 - 23.0	Moderate undernutrition	0.0	1.4	0.8
23.1 - 24.0	Mild undernutrition	4.3	8.1	6.6
Above 24	Normal nutrition	87.2	83.8	85.1

4.4 Diabetic Self-Care Activities

Diabetic patients in the study sample were given various types of recommendations by their health care providers in order to be able to undertake their self-care well. Regarding diet, they were advised to eat complex carbohydrate, low fat diet, generous amounts of

fruits and vegetables, high fiber foods, to reduce energy intake if over weight and to avoid high sugar foods. Regarding exercises, they were advised to get low level of exercises (such as walking) on daily basis, to do physical exercises in their daily routine and to physical exercise continuously for at least 20 minutes, three times a week. For blood glucose test, it was recommended to test their blood glucose regularly.

The level of self-care practice was determined by the number of days per week individuals practiced desired activities. To be able to tell the proportion of study subjects that had a certain level of self-care practice, the practices were grouped into four categories as summarized in Table 19.

Table 19: Categories of self-care practices

Category	Level of practice
0 - 2. 0 days per week	Very low level
2.1 - 4.0 day per week	Low level
4.1 - 6.0 days per week	Moderately high level
6.1 - 7.0 days per week	High level

4.4.1 Diet

The diet practices were determined by asking five questions on how the participants in the past seven days had accomplished various diet related practices. The results are given in Table 20. The average score for general diet was 4.6 ± 2.4 days per week while for specific diet was 3.7 ± 1.5 days per week. The average score for males in general diet was 4.7 ± 2.4 days per week while the score for females was 4.5 ± 2.5 days per week. Regarding specific diet, average score for males was 3.8 ± 1.3 days per week while for female it was 3.7 ± 1.7 days per week. It can be noted that, male participants scored a little

higher in almost all aspect of diet compared to their female counterparts, however the differences were not statistically significant ($p < 0.05$) for all the categories**.**

Based on the self-care categories (Table 19), the results of general diet practice indicated that, 39.7% (n = 121) had high level of diet practice, 18.2% (n = 121) had moderately high level of diet practice, 23.1% (n = 121) had low level of practice while 19.0% (n = 121) had very low level of diet practice. In the case of specific diet, only 9.1% (n = 121) of respondents had high level of diet practice, 19.8% (n = 121) had moderately high level of diet practice, 58.7% (n =121) had low level of diet practice and 12.4% (n =121), had very low level of diet practice. The level of practice for individual items is shown in (Table 21). People with diabetes are required to limit intake of high fat foods especially fat from animal sources. The fact that 84.3% (n = 121) of the respondents were having very low level of self-care practice in eating high fat foods was a good healthy practice (Table 21).

Table 20: Diet practices realated to general and specific diet (n = 121)

Practice	M&F	Male	Female
How many of the last seven days have you followed a healthful eating plan?	4.6±2.6	4.6±2.6	4.5±2.6
On average, over the past month, how many days per week had you followed your eating plan?	4.6±2.5	4.8±2.4	4.4±2.5
On how many of the last seven days did you eat five or more servings of fruits and vegetables?	1.6±2.4	1.5±2.4	1.6±2.5
How many times do you eat fruits per day?	1.3±1.0	1.4±1.0	1.2±0.9
How may times do you eat vegetable per day?	1.7±0.9	1.6±0.7	1.7±0.9
On how many of the last seven days did you eat high fat foods such as red meat or full-fat dairy products?	1.1±2.1	1.0±2.1	1.2±2.2
On how many of the last seven days did you space carbohydrates evenly through the day?	3.9±2.9	3.6±2.9	4.1±2.9

Values in a column are mean ± SD

Table 21: Levels of self-care practice related to diet (n = 121)

Practice	Level of practice n(%)			
	Very low	Low	Moderately High	High
How many of the last seven days did you follow a healthful eating plan?	30(24.8)	24(19.8)	13(10.7)	54(44.6)
On average, over the past month, how many days per week did you follow your eating plan?	23(19.0)	31(25.6)	21(17.4)	46(38.0)
How many of the last seven days did you eat five or more servings of fruits and vegetables?	87(71.9)	18(14.9)	1(0.8)	15(12.4)
How many of the last seven days did you eat high fat foods such as red meat or full-fat dairy products?	102(84.3)	5(4.1)	4(3.3)	10(8.3)
How many of the last seven days did you space carbohydrates evenly through the day?	47(38.8)	17(14.0)	8(6.6)	49(40.5)

The participants were also requested to estimate the amount of vegetable they ate per day by using a standard cup. The findings were that, only 28.1% (n = 121) ate more than one cup per day, while the rest (71.9%, n = 121) ate one or less than one cup of vegetable per day (Figure 5).

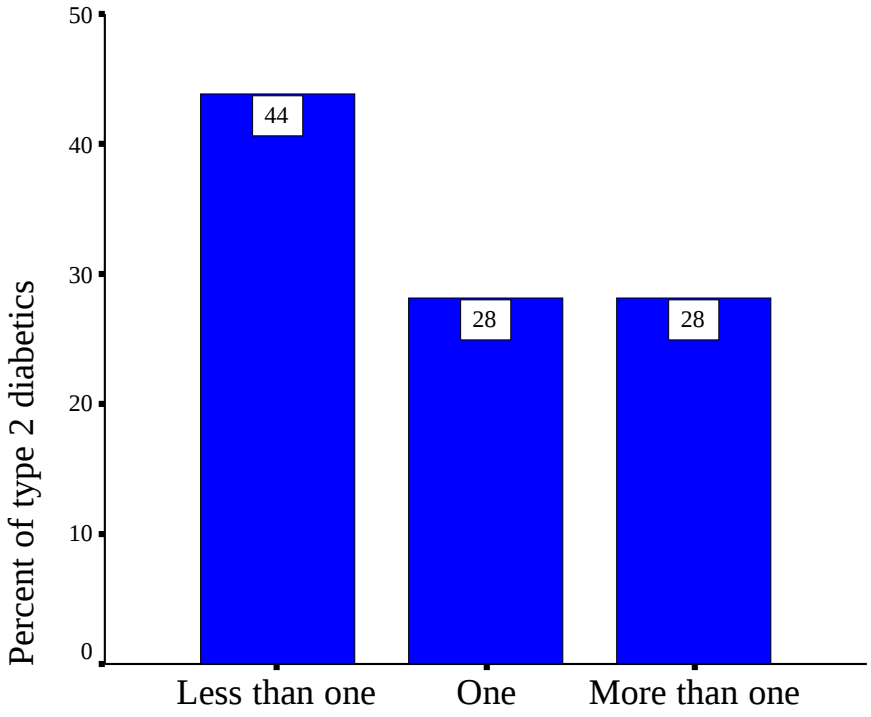

Figure 5: Estimated amount of vegetable (in cups) consumed per day

The findings of general and specific diet reported in other studies (Glasgow and Toobert, 2000) were comparable to those obtained in this study. This study showed that, despite of the low income of the diabetic subjects, many tried to allocate resource for their care (Table 22).

It was observed in this study that, 57.9% (n = 121) of the studied sample had moderately high to high level of self-care practice in the general diet, and only 28.9% (n = 121) scored high level and moderately high level in self-care practice in specific diet. This observation

was of concern because the patients were required to score higher in order to achieve glycemic control and good quality of life.

Consumption of fruits and vegetable was also very low. About 72% (n = 121) scored very low level, while 14.9% (n = 121) scored low level of practice in fruits and vegetables consumption. This suggested that, the micronutrient nutrition of the diabetic people involved in the study might not be good. Concerted efforts are thus needed to improve the consumption of fruits and vegetables.

4.4.2 Physical exercises

Two questions were asked to determine the physical exercise practices for the subjects. When the respondents were asked about how many of the last seven days they participated in at least 30 minutes of physical activity, i.e. 30 minutes of continuous activity, including walking, the average score was 5.7 ± 2.4 days per week, with males scoring 6.1 ± 2.1 days per week and females scoring 5.5 ± 2.5 days per week. In this category of activities males scored higher than females, however, the difference was not statistically significant ($t = 1.541$, $p = 0.126$).

Table 22: Summary of findings of self-care practices on general diet, specific diet and physical exercise from various studies

Study	n	Sample characteristics	Scale	Items	Average value (%)
Glasgow *et al.*, 1992	105	-100% type 2 diabetes -Mean age = 67±, SD = 5 years -63% women -27% on insulin -Mean diabetes duration = 9.4, SD = 8.6 years	General diet Specific diet Exercise	2 3 3	64.9 ± 21.2 77.8 ± 11.9 55.2 ± 32.4
Glasgow *et al.*, 1998	201	-79.4% type 2 diabetes -Mean age = 62, SD = 11 years -60% women -67% on insulin -Mean diabetes duration = 13, SD = 11.1 years	General diet Specific diet Exercise	2 3 3	67.0 ± 20.8 78.3 ± 16.5 39.1 ± 33.0
Glasgow *et al.*, 1999	260	-63.0% type 2 diabetes -Mean age = 45, SD = 12 years -49% women -54% on insulin -Mean duration = 9.5, SD = 10.7 years	General diet Specific diet Exercise	2 3 1	55.8 ± 32.4 63.4 ± 20.0 32.7 ± 33.1
Glasgow and Toobert, 2000	321	-100% type 2 diabetes -Mean age = 59, SD = 9 years -57% women -15.5% on insulin -Mean duration = 6.3, SD = 6.2	General diet Specific diet Exercise	2 3 2	48.1 ± 30.8 62.9 ± 17.8 24.7 ± 27.9
Observed (2006)	121	100% type 2 diabetes -Mean age = 53, SD = 10.9 years -61.2% women -19% on insulin -Mean duration = 6.1, SD = 7.1	General diet Specific diet Exercise	2 2 2	65.6±34.8 53.3±22.1 49.2±26.1

Source: Findings in this table were adopted from the cited studies except for the observed data.

When the respondents were asked about how many of the last seven days they participated in a specific exercise session (such as swimming, walking, biking) other than what they do around the house or as part of their work, the average score was 1.2 ± 2.3 days per week with males scoring 1.8 ± 2.8 days per week and females 0.8 ± 1.9 days per week. In this category of activities males scored significantly higher ($t = 2.201$, $p = 0.031$) than females.

When the two categories of exercises were combined to form a general score for physical exercise, the average score was 3.4 ± 1.8 days per week with males scoring 3.95±1.89 days per week and females 3.12 ± 1.71 days per week. In general, males had significantly higher level of physical exercises ($t = 2.508$, $p = 0.013$) than females. The level of physical exercises in the study group was generally low, since only 11.6% (n = 121) had high level of exercises self care practice, 9.1% (n = 121) had moderately high level of practice, 60.3% (n = 121) had low level of practice 19.0% (n = 121) had very low levels of practice (Table 23).

Most participants did physical exercises as part of their work or part of chores around the house but not as a separate exercise session. The results on physical exercise practice were better than those reported in other studies (Glasgow and Tolbert, 2000; Glagow *et al.*, 1998, 1999). Respondents in this study scored significantly higher percent (49.2±26.1%) ($t=10.348$, $p=0.000$) than the score (24.7 ± 27.9%) reported by Glasgow and Toobert, (2000) (Table 22). These findings can be explained by the fact that in this study most of the participants were of low income bracket who did most of their activities manually. This made them to score higher in physical exercise (Table 22).

Table 23: Levels of self-care practice related to physical exercises (n = 121)

Practice	Level of practice n(%)			
	Very low	Low	Moderately High	High
How many of the last seven days did you participate in at least 30 minutes of physical activity? (Total minutes of continuous activity, including walking).	19(15.7)	6(5.0)	6(5.0)	90(74.4)
How many of the last seven days did you participate in a specific exercise session (such as swimming, walking, biking) other than what you do around the house or as part of your work?	97(80.2)	8(6.6)	3(2.5)	13(10.7)

Despite scoring high percent in physical exercises, action needs to be taken to improve the level of physical exercises, especially planned aerobic exercises in which majority of the participants (80.2%, n = 121) scored very low. There is a need to teach them the benefits of physical exercises and how to do physical exercises without increasing the risk of injury and hypoglycaemia.

4.4.3 Blood glucose test

Self monitoring of blood glucose (SMBG) is a vital part of diabetic self-care and is a useful tool in helping patients controls their blood glucose, hence reducing the risk of developing diabetes related complications. When the study participants were asked if they have ever tested their blood glucose levels since the last time they visited a diabetic clinic (about three months), 53.7% (n = 121) reported to have tested while 46.3% (n = 121) reported that they have never tested. This observation contradicted findings reported by Smide (2002). In a study involving 150 Tanzanian diabetics, Smide (2002) observed that, none of them did self-monitoring of their blood glucose. Result of this study showed

nevertheless that, the blood glucose testing was not regular. The number of tests since the last appointment (three months) were very few, ranging from 0 to 60 tests (mean of 2.4 ± 6.2 tests), with males scoring higher (2.8±8.8 tests) than females (2.2 ± 3.6 tests) ($t = 0.489$, $p = 0.626$). When analysis was done for only those who said they tested at least once since last visit to the diabetic clinic, the average number of tests was 4.5 ± 7.8 with males scoring higher (5.4 ± 11.9 tests) than females (4.0 ± 4.1 tests) ($t = 0.713$, $p = 0.479$). When participants were asked to give the reasons for testing blood glucose, they gave a diversity of reasons as summarized in Table 24. Three main reasons for testing blood glucose were, malaise and feeling of sickness (46.2%, n = 65), to know their level of blood glucose, (36.9%, n = 65) and suffering from malaria (10.8%, n = 65). The main reason given for not testing the blood glucose was the high cost of the test; which was about 1 US dollar per test.

Table 24: Reasons for testing blood glucose (n = 65)

Reasons	Count	%Cases [1]
To know my blood glucose level	24	36.9
Dizziness	3	4.6
Malaise	30	46.2
Blurred vision	6	9.2
Feeling numbness in the extremities	3	4.6
Sweating profusely	2	3.1
Palpitation	1	1.5
Nausea	1	1.5
Headache	4	6.2
Frequently urination	4	6.2
Advised by my health care provider	3	4.6
Checking results of using diet instead of drugs	1	1.5
Offer from my employer	2	3.1
Sick and admitted in hospital	2	3.1
Suffering from Malaria	7	10.8
To check effect medicine	2	3.1
To help in regulating insulin dose	1	1.5
Total	**92**	**147.7**

[1] Add to more than 100% due to some answers given more than once

4.4.4 Foot-care practices

Foot-care practices were assessed by five questions, in which the first two questions were core questions. When the two core questions were combined, they gave the general foot-care score. The combined score included the questions asking about how many in the last seven days did they check their feet and how many in the last seven days did they inspect the inside of their shoes. The average score from this combination was 3.6 ± 2.8 days per week, in which the score for male respondents was 4.2 ± 2.7 days per week while the score for the female respondents was 3.2 ± 2.9 days per week. The score of diabetic males

on foot-care was significantly higher (t = 1.984, p = 0.05) than the score for females. Individual items representing foot self-care practices are presented in Table 25.

Table 25: Foot-care practices (n = 121)

Practice	General	Male	Female
How many of the last seven days did you check your feet?	3.2±3.4	3.8±3.5	2.9±3.3
How many of the last seven days did you inspect the inside of your shoes?	3.9±3.4	4.6±3.4	3.5±3.4
How many of the last seven days did you wash your feet?	6.6±1.5	6.3±1.8	6.7±1.2
How many of the last seven days did you soak your feet?	0.3±1.3	0.6±2.0	0.03±0.2
How many of the last seven days did you dry between your toes after washing?	4.3±3.4	4.6±3.3	4.2±3.4

Values in a column are Means ± SD

The level of foot-care in the study sample was moderately high as shown in the combined foot-care category, in which case, 24.8% (n = 121) of the respondents had high level of foot-care practice, 54.5% (n = 121) had moderately high level of foot-care practice, 19.0% (n = 121) had low level of foot-care practice while 1.7% (n = 121) had very low level of foot-care practice. The levels of care practice for individual foot items are shown in (Table 26). Soaking the feet affect the skin and make it susceptible to infections. Thus it is not advised for diabetic people to soak their feet. Having a very low proportion of diabetic subjects practicing feet soaking was a desirable health practice.

Table 26: Foot -care levels of self-care practices (n = 121)

Practice	Level of practice n(%)			
	Very low	Low	Moderat	High

			ely High	
On how many of the last seven days did you check your feet?	63(52.1)	5(4.1)	0(0.0)	53(43.8)
On how many of the last seven days did you inspect the inside of your shoes?	54(44.6)	1(0.8)	0(0.0)	66(54.5)
On how many of the last seven days did you wash your feet?	7(5.8)	3(2.5)	0(0.0)	111(91.7)
On how many of the last seven days did you soak your feet?	117(96.7)	0(0.0)	0(0.0)	4(3.3)
On how many of the last seven days did you dry between your toes after washing?	46(38.0)	2(1.7)	0(0.0)	73(60.3)

Based on the results, the average number of feet inspection was 3.2 ± 3.4 days per week and the inspection of shoes was 3.9 ± 3.4 days per week. According to ADA (2006a), diabetic patients are advised to inspect their feet every day and seek care as early as possible if they get foot injury. Majority of the subjects in our study fall short of meeting the recommendation by ADA (2006a) because they neither inspected their feet nor their shoes daily. The reason for inspecting inside the shoes every day before wearing is to remove any thing that can injure the foot. Foot wounds are the most common diabetes-related cause of hospitalisation and is the most common cause of non-traumatic amputation of the lower limb (Boulton and Vileikyte, 2000; WHO, 2003; and Boulton et al., 2005b). Individuals with diabetes have a 30-fold higher lifetime risk of undergoing a lower-extremity amputation compared with those without diabetes (Lavery *et al.*, 1996, 1999). Majority of the participants washed their feet every day (91.7%, n = 121) and 60.3% (n = 121) of them dried their feet after washing them. These practices were necessary to prevent foot injury and infection and thus reduce the risk of infection.

4.4.5 Cigarette smoking

For people with Type 2 diabetes, cigarette smoking is one of the risk factors for cardiovascular diseases. Other risk factors for CVD include high plasma total cholesterol, family history of CVD and hypertension (Schwartz, 2005). In the study sample, only 2.5% (n = 121) of subjects were active smokers while 0.8% (n =121) of the subjects sniffed tobacco. This indicated that, prevalence of smoking among the subjects was generally low. This practice helped them to minimize the risk for CVD, which is a leading cause of morbidity and mortality for people with diabetes. Regarding history of smoking, 20.7% (n = 121) of the respondents have smoked in the past and 90.5% (n = 25) of these stopped smoking in the past two years. For subjects who were active smokers, they smoked an average of 4.7 ± 3.1 cigarettes per day, (range 2 - 8 cigarettes).

4.4.6 Medication practices

4.4.6.1 Conventional medicine

In the study sample, majority (76.9%, n=121) of the respondents were on oral hypoglycaemic drugs, 19% (n = 121) were on insulin while only 4.1% (n=121) were on diet. Regarding treatment regimen in the last 7 days, the respondents used diabetic therapy on an average of 5.45 ± 2.76 days (95% CI. mean = 4.95 - 5.45 days).

The level of use of medication in the study sample was high, in which 72.7% (n = 121) had high level of medication, 3.3% (n = 121) had moderately high level of medication, 4.1% (n=121) had low level of medication while 19.8% (n = 121) had very low level of medication.

The main goal of diabetic treatment is to keep blood glucose level within normal range as much as possible. Completely normal level is difficult to maintain, but the more closely it can be kept within normal range, the less likely that, temporary or long-term complication will develop (Berkow *et al.,* 1997). Medication is one of the important aspect of diabetic care because it is usually established when other methods have failed to maintain the desired gylcemic control. In this case, it is important for patients to have complete adherence to medication in order to achieve the required glycemic control. Phycians are also required to play their part by reviewing the effect of medication and change the dosage and the type of medication whenever necessary in order to achieve the desired glycemic control. The fact that, 27.3% (n = 121) of respondents had low and very low level of practice in medication, is a matter that requires a serious consideration. Majority of those whose level of medication use was low reported that, lack of money for buying the medication was the major limitation (Table 27). It is important that the government health programs, health insurance companies and other stakeholders take an active participation to assist the diabetic people to access the basic medication needed.

Respondents, whose medication practices were low, were requested to give reasons as to why their practices were not good. About 27.3% (n = 121) of the respondents were not on medication or were on diet during the interview, 15.2% (n = 33) of the respondents who were not on medication, were on diet as recommended by their phycians, while 6.1% (n = 33) were on self-imposed diet regime but were also supposed to use medication. The reasons for not following the prescribed medication are summarized in Table 27.

Table 27: Reasons for improper following of drugs schedule

Reason	Frequency	Percent

No money to buy medication	22	78.6
Forgetfulness	1	3.6
Drug side effects	1	3.6
Low level of blood glucose	2	7.1
On diet therapy	2	7.1
Total	**28**	**100.0**

4.4.6.2 Alternative medicine

When asked whether they have ever used any traditional/herbal medicine for their disease, the results showed that, majority (87.6%, n = 121) were not currently using alternative medicine, while only 12.4% (n = 121) were using alternative/traditional medicine. Out of those who were not currently using alternative medicine, 51.9% (n = 106) had used them before while the rest (48.1%, n = 106) had never used them. Although herbs used for diabetes treatment are less likely to have the drawbacks of conventional drugs, potential adverse herb-drug interactions should be kept in mind for patients receiving conventional ant diabetic medications (Dey *et al.,* 2002).

4.5 Diabetes Related Psychosocial Distress

The data for determining diabetic related psychosocial distress was collected by the Problem Areas in Diabetes (PAID) tool. To facilitate interpretation of the PAID, results were transformed to a 0 - 100 scale with higher scores indicating greater emotional distress. Also, for further breakdown of emotional distress, a four factors solution as described by Snoek *et al.* (2000) was used. The four factors were, diabetes related emotion distress represented by 12 items, treatment related problems represented by three items, food related problems represented by three items and social support related problems represented by two items.

The mean score for PAID was 22.9 ± 16.9 in which females seemed to have higher score (24.0 ± 17.3) than their male counterparts (21.1±16.2), although the difference was not significantly different (t = -0 .926, p = 0.356). In the four factors of the PAID, males scored lower in two factors which were diabetic related emotion distress and foot related problems while females scored lower in treatment related problems and social support related problems. However, the differences in all categories were not statistically different ($p < 0.05$) (Table 28).

Table 28: Distribution of diabetic related emotion distress by gender[1]

Factors	Sex of the respondent	n	Mean	Std. Deviation	Std. Error Mean
Diabetes related emotion distress	Male	47	10.96	9.33	1.36
	Female	74	12.53	9.77	1.14
Treatment related problems	Male	47	2.55	2.33	0.34
	Female	74	2.45	2.39	0.28
Food related Problems	Male	47	2.30	2.55	0.37
	Female	74	3.20	3.10	0.36
Social support related problems	Male	47	1.08	2.00	0.29
	Female	74	1.05	1.54	0.18

[1] Maximum score for each category differ but minimum score is zero. Maximum score for diabetes related emotion distress was 48 (range, 0 – 48), score for treatment related problems was 12 (range, 0 – 12), and score for food related problems was 12 (range, 0 – 12), while the score for social support related problems was 8 (range, 0 – 8). The lower the score the lower was the problem.

Results of the PAID obtained in this study were comparable to those of other studies conducted in USA (Welch *et al.*, 1997) and Netherlands (Snoek et al., 2000). Diabetic patients in this study scored an average of 22.9 ± 16.9, while those in the USA (Welch *et al.*, (1997) scored an average of 27.8 ± 23.2. Those in the Netherlands study (Snoek et al., (2000). scored an average of 22.5 ± 19.8, which was slightly lower than that obtained in this study (22.9 ± 16.9) (t = .262, p = 0.794).

When compared with other studies (Snoek *et al;* 2000, Welch *et al;* 1997) the diabetics in this study scored the lowest in the social support related emotional distress. The social support score in this study was 1.1 ± 1.7 while the scores reported from other studies were 1.6 ± 2.4 (Snoek *et al.* (2000) and 1.8 ± 2.4 (Welch *et al.*, (1997). This implied that, diabetics in this study had high level of social support and that is why they had low level of social related emotional distress. Research on the association between social support and chronic illness has demonstrated a significant positive relationship between social support and health (Whittemore *et al.*, 2005). In diabetes research, social support has been associated with better psychosocial adjustment (White *et al.*, 1992) and decreased risk of depression (Willoughby *et al.*, 2000). Since the patients in this study had high social support and hence lower distress compared to subjects in the other studies, this may have affected the PAID score which showed similarity with those of patients in developed countries. Another factor for the better PAID was that, our study subjects scored better in acceptance of the condition (0.04 ± 0.3) compared to those in other studies (Netherlands 0.8 ± 1.4, Snoek *et al.*, 2000) and (USA 1.0 ± 1.4, Welch et al., 1997). Almost all the respondents in our study (98.3%, n = 121) had accepted to live with the diabetic condition,

0.8% (n = 121) had moderate problem accepting diabetes while 0.8% (n = 121) others had somewhat serious problem to accept their condition.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The studied sample included 121 people living with Type 2 diabetes. Majority of them were married and women constituted more than half of the study participants. The studied sample had low to moderate level of education in which 70.2% (n = 121) had no formal education or had primary education level. Only (21.5%, n = 121) of the respondents perceived their income as enough for their daily needs. The average duration of living with diabetes was 6.1 ± 7.1 years and the majority (61%, n = 121) has lived with diabetes for up to five years. The average fasting blood glucose was 11.2 ± 5.5 mmol/l and was above the minimum recommended level (7.8 mmol/l) above which the diabetes related complications are likely to occur. The average blood pressure (134.7/86.1 mm/Hg) observed in this study was slightly below the cut off point for classic hypertension (140/90 mm/Hg). Average BMI for females (27.0 ± 5.1 kg/m^2) was significantly higher ($p = 0.031$) than that of males (25.0 ± 4.3 kg/m^2).

The level of self-care practices was determined in the area of diet, physical exercises, medication use, foot care and blood glucose testing. The score for general diet was relatively high (4.6 ± 2.4 days per week) compared to specific diet (3.7 ± 1.5 days per week). Males participants scored a little higher in all aspects of diet compared to their females counterparts, however, the differences were not statistically significant ($p < 0.05$) for all the categories. Consumption of fruits and vegetable was very low in which 72% (n = 121) of the study participants scored very low practice. Most of the study participants did physical exercises as part of their work or part of their daily chores but not as separate

sessions of planned exercises. The average level of doing physical exercises was (5.7 ± 2.4 days per week) while score for specific exercises (separate session of planned exercises) was 1.2 ± 2.3 days per week. In case of blood glucose monitoring, the study participants tested their blood glucose on irregular basis especially when there were specific health problems and the average number of tests were 2.4 ± 6 times per three months. The average foot-care score was (3.6 ± 2.8 days per week) in which, the score for male respondents was 4.2 ± 2.7 days per week while the score for females was 3.2 ± 2.9 days per week. It was observed that, the foot-care score increased with the increase in duration of living with diabetes. In the study sample, the majority (76.9%, n = 121) were on oral hypoglycaemic drugs, 19% (n =121) were on insulin, while only 4.1% (n = 121) were on diet therapy. Compliance to the diabetic therapy as recommended was on an average of 5.5 ± 2.8 days per week. About a third of study participants had some problems complying with the use of medication. The most common problem was lack of money to buy medicine for diabetes. Financial problems were also a major constraint in executing other self-care practices such as diet and physical exercises. The diabetic related emotional distress among the respondents was generally low and was comparable to distress levels reported from other studies.

Diabetic subjects, regardless of their economic situation, tried to take care of themselves. In the study sample, diabetic males scored relatively higher than females in almost all aspect of self-care. Consumption of fruit and vegetables scored the lowest followed by physical (structured) exercises. There was improvement in self-monitoring of blood glucose compared to findings reported in other studies done in Tanzania. Foot-care scores were moderately high and the footcare score increased with the duration the subjects lived with the disease. Most of the study participants used their medication as prescribed by

their health providers. Those who were having problems with medication were those who could not afford the drugs.

It may therefore be concluded that, the level of self-care practices in areas of diet, physical exercises, medication, and blood glucose testing was not up to the desired level of practice. It is recommended that diabetic subjects should observe the recommended care practices seven days per week without missing. Diabetic related emotion distress for the studied sample was low and comparable to levels reported in other studies, however, the level was not in line with the score recommended in PAID. The recommended PAID score for emotional distress is zero. For this reason, efforts are needed to reduce the emotional stress among the diabetic subjects. The main problem in self-care was financial limitation and lack of care education. Efforts are therefore required to improve the quality of care including self-care education, counselling and medical support. This will enable people with diabetes to achieve higher level of self-care and reduce the level of diabetic related emotional distress. This in turn will help to ensure good glycemic control, reduce the risk of diabetic complications and improve the quality of life.

5.2 Recommendations

(a) Effort should be made by the Government and other health stakeholders to lower the cost of diabetic services like diabetic tests and medications and ensure that those services are available at all times in Government clinics attending people with diabetes. For those who cannot afford the services, they should be provided free of charge or at subsidized rates.

(b) Given the importance of Self-monitoring of blood glucose in diabetic care, the Government, and other health stakeholders should strive to make the procedure readily accessible and affordable by all people who require it.

(c) Further research is needed to determine optimum self-care practices and diabetic related emotional distress levels that can predict good glycemic control that would help researchers and programme managers to monitor the progress of diabetic subjects.

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APPENDICES

Appendix 1: Study questionnaire

ASSESSMENT OF SELF CARE PRACTICES AND PSYCHOSOCIAL DISTRESS FOR PEOPLE WITH TYPE 2 DIABETES MELLITUS IN DAR ES SALAAM TANZANIA

QUESTIONNAIRE

Individual ID No. |___|___|___|

Date: d/m/yy |___|___||___|___||___|___|___|___|

Name of Hospital: …….

SECTION A: CLINICAL AND NUTRITIONAL CHARACTERISTICS

A1: Systolic Blood Pressure: …….mmHg

A2: Diastolic Blood Pressure: …….mmHg.

A3: Fasting Blood Glucose: …….. mmol/l

A4: Mid upper arm circumference:…… mm

A5: Waist circumference:……cm

A6: Hip circumference: ……...cm

A7: Weight: …… kg.

A8: Height: ……..cm

SECTION B: DEMOGRAPHIC INFORMATION

B1: Age: ……..Years at last birth day

B2: Sex:

- ☐ 1 Male
- ☐ 2 Female

B3: Marital Status:

- ☐ 1. Married
- ☐ 2. Single

☐ 3. Divorced

☐ 4. Separated

☐ 5. Cohabiting

☐ 6. Widowed

B4: Do you have children?

☐ Yes 1

☐ No 0

B5: If Yes how many children?

☐ 1. One (1) to Two (2)

☐ 2. Three (3) to Four (4)

☐ 3. Five (5) to Six (6)

☐ 4. Seven (7) or more

B6: How many children live with you? _____

B7: How many people do you live with at home? _____

B8: What is your highest level of education?

☐ 1. No formal education

☐ 2. Primary education

☐ 3. Secondary education

☐ 4. Post secondary or non-university

☐ 5. University

B9: What is your current occupation?

☐ 1. Wage employment.

☐ 2. Petty business.

☐ 3. Business.

☐ 4. Crop farming

☐ 5. Livestock farming

☐ 6. Mixed farming

☐ 7. Other (specify)……

B10: How adequate is your income to meet your daily living expenses?

☐ 1. Enough

☐ 2. Barely enough

☐ 3. Totally inadequate

B11: What is your religion?

- ☐ 1. Christian
- ☐ 2. Muslim
- ☐ 3. Hinduism
- ☐ 4. Buddhism
- ☐ 5. Traditional religion
- ☐ 6. Other ☐ (Specify)……

B12: For how long have you been living with Diabetes? …….

B 13: Does your family have any history of Diabetes?

- ☐ 1 Yes
- ☐ 0 No

SECTION C:

SUMMARY OF DIABETES SELF CARE ACTIVITIES (SDSCA) MEASURE)

The questions below ask you about your diabetes self-care activities during the past 7 days. If you were sick during the past 7 days, please think back to the last 7 days that you were not sick.

Please encircle the number which correspond to your level of activities

C1: Diet

C1.1: How many of the last SEVEN DAYS have you followed a healthful eating plan?

0 1 2 3 4 5 6 7

C1.2: On average, over the past month, how many DAYS PER WEEK have you followed your eating plan?

0 1 2 3 4 5 6 7

C1.3: On how many of the last SEVEN DAYS did you eat five or more servings of fruits and vegetables?

0 1 2 3 4 5 6 7

C1.3 (a) How many times do you eat fruits per day?……..

C1.3 (b) How many times do you eat vegetable per day…….

C1.3 (c) How much of vegetables do you eat per day (give estimation by using a cup of tea)……

C1.4: On how many of the last SEVEN DAYS did you eat high fat foods such as red meat or full-fat dairy products?

0 1 2 3 4 5 6 7

C1.5: On how many of the last SEVEN DAYS did you space carbohydrates evenly through the day?

0 1 2 3 4 5 6 7

C2: Exercise

C2.1: On how many of the last SEVEN DAYS did you participate in at least 30 minutes of physical activity? (Total minutes of continuous activity, including walking).

0 1 2 3 4 5 6 7

C2.2: On how many of the last SEVEN DAYS did you participate in a specific exercise session (such as swimming, walking, biking) other than what you do around the house or as part of your work?

0 1 2 3 4 5 6 7

C3: Blood Sugar Testing

C3.1: Have you ever tested your blood glucose since the last time you visited the diabetic clinic?

☐ 1 Yes

☐ 0 No

C.3.2 If yes, how many times have you tested? ……

C3.3: What made you to decide to check your blood glucose level?

1. ……..
2. ……..
3. ……..
4. ……..

5…….

C4: Foot Care

C4.1: On how many of the last SEVEN DAYS did you check your feet?

0 1 2 3 4 5 6 7

C4.2: On how many of the last SEVEN DAYS did you inspect the inside of your shoes?

0 1 2 3 4 5 6 7

C4.3: On how many of the last SEVEN DAYS did you wash your feet?

0 1 2 3 4 5 6 7

C4.4: On how many of the last SEVEN DAYS did you soak your feet?

0 1 2 3 4 5 6 7

C4.5: On how many of the last SEVEN DAYS did you dry between your toes after washing?

0 1 2 3 4 5 6 7

C5: Smoking

C5.1: Are you smoking or have you ever-smoked cigarette?

☐ Do not smoke 1

☐ I, Smoke 2 [Go to C5.2]

☐ Do not smoke, but I used to smoke in the past. 3

C5.2: If yes, how many cigarettes did you smoke on an average a day?

Number of cigarettes:…….

C5.3: At your last doctor's visit, did anyone ask about your smoking status?

☐ No 0

☐ Yes 2 1

C5.4: If you smoke, at your last doctor's visit, did anyone counsel you about stopping smoking or offer to refer you to a stop-smoking program?

☐ No 0

☐ Yes 1

C5.5: When did you last smoke a cigarette?

☐ 1. More than two years ago, or never smoked

☐ 2. One to two years ago

☐ 3. Four to twelve months ago

☐ 4. One to three months ago

☐ 5. Within the last month

☐ 6. Today

C6: Medications

C6.1: On how many of the last SEVEN DAYS, did you take your recommended diabetes medication?

0 1 2 3 4 5 6 7

C 6.2: If the medication/other therapy were not followed properly throughout the week, give reasons:

☐ 1. No money to buy medications

☐ 2. Forgetfulness

☐ 3. Drugs side effects

☐ 4 Fear of injection

☐ 5. Feeling that I am cured

☐ 6. Other (specify)……...

C6.3 Are you taking any traditional/Chinese/herbal medicine for your Diabetes?

☐ No 0

☐ Yes1 [Go to question C7.1]

C6.4 If, No. Have you ever used any traditional/Chinese/herbal medicine for your Diabetes?

☐ No 0

☐ Yes1

C7: SELF-CARE RECOMMENDATIONS

C7.1: Which of the following has your health care team (doctor, nurse, dietitian, or diabetes educator) advised you to do?

Please check all that apply:

☐ a. Follow a low-fat eating plan

☐ b.Follow a complex carbohydrate diet

☐ c. Reduce the number of calories you eat to lose weight

☐ d.Eat lots of food high in dietary fiber

☐ e. Eat lots (at least 5 servings per day) of fruits and vegetables

☐ f. Eat very few sweets (for example: desserts, non-diet sodas, candy bars)

☐ g.Other (specify):……

☐ h.I have not been given any advice about my diet by my health care team.

C7.2: Which of the following has your health care team (doctor, nurse, dietitian or

diabetes educator) advised you to do?

Please check all that apply:

☐ a. Get low level exercise (such as walking) on a daily basis.

☐ b.Exercise continuously for at least 20 minutes at least 3 times a week.

☐ c. Fit exercise into your daily routine (for example, take stairs instead of elevators, park a block away and walk, etc.)

☐ d.Engage in a specific amount, type, duration and level of exercise.

☐ e. Other (specify):……..

☐ f. I have not been given any advice about exercise by my health care team.

C7.3: Which of the following has your health care team (doctor, nurse, dietitian, or diabetes educator) advised you to do?

Please check all that apply:

☐ a.Test your blood sugar regularly.

☐ b.Other (specify):……

☐ c. I have not been given any advice either about testing my blood sugar level by my health care team.

C7.4: Which of the following medications for your diabetes has your doctor prescribed? Please check all that apply.

☐ a. An insulin shot 1 or 2 times a day.

☐ b. An insulin shot 3 or more times a day.

☐ c. Diabetes pills to control my blood sugar level.

☐ d.Other (specify):…….

☐ e. I have not been prescribed either insulin or pills for my diabetes.

SECTION D:

PROBLEM AREAS IN DIABETES (PAID) QUESTIONNAIRE

Problem Areas In Diabetes (PAID) Questionnaire

INSTRUCTIONS:

Which of the following diabetes issues are currently problems for you?

Circle the number that gives the best answer for you. Please provide an answer for each question

Index: Not a problem = 0 ; Minor problem =1 ;Moderate problem =2 ;Somewhat serious problem =3; Serious problem = 4

D1: Not having clear and concrete goals for your diabetes care?	0	1	2	3	4
D2: Feeling discouraged with your diabetes treatment plan?	0	1	2	3	4
D3: Feeling scared when you think about living with diabetes?	0	1	2	3	4
D4: Uncomfortable social situations related to your diabetes care (e.g., people telling you what to eat)?	0	1	2	3	4
D5: Feelings of deprivation regarding food and meals?	0	1	2	3	4
D6: Feeling depressed when you think about living with diabetes?	0	1	2	3	4
D7: Not knowing if your mood or feelings are related to your diabetes?	0	1	2	3	4
D8: Feeling overwhelmed by your diabetes?	0	1	2	3	4
D9: Worrying about low blood sugar reactions?	0	1	2	3	4
D10: Feeling angry when you think about living with	0	1	2	3	4

diabetes?					
D11: Feeling constantly concerned about food and eating?	0	1	2	3	4
D12: Worrying about the future and the possibility of serious complications?	0	1	2	3	4
D13: Feelings of guilt or anxiety when you get off track with your diabetes management?	0	1	2	3	4
D14: Not "accepting" your diabetes?	0	1	2	3	4
D15: Feeling unsatisfied with your diabetes physician?	0	1	2	3	4
D16: Feeling that diabetes is taking up too much of your mental and physical energy every day?	0	1	2	3	4
D17: Feeling alone with your diabetes?	0	1	2	3	4
D18: Feeling that your friends and family are not supportive of your diabetes management efforts?	0	1	2	3	4
D19: Coping with complications of diabetes?	0	1	2	3	4
D20: Feeling "burned out" by the constant effort needed to manage diabetes?	0	1	2	3	4

SECTION E: CONSTRAINS AND RECOMMENDATION

E1. What are the major constraints you encounter in your diabetic self care?

1. …….
2. …….
3. ……

E2. In your opinion, what help and support you need in order to improve your ability to care for your self more effectively.

5. ……..
6. ……..
7. ……..
8. ……..

Appendix 2: Consent form

ID NO

CONSENT TO PARTICIPATE IN A RESEARCH PROJECT

Greetings! My name is Mr. Rashidi Heri and I am a Nurse working with Muhimbili University College of Health Sciences as a Teacher. Currently I am a postgraduate student at Sokoine University of Agriculture taking Master of Science in Human Nutrition. I am conducting a study titled; Assessment of self care practices and psychosocial distress for people with type 2 diabetes mellitus in Dar es Salaam Tanzania

Purpose of the Study

The purpose of this study is to determine the self-care practices and psychosocial distress for type 2 diabetics in Dar es Salaam and to propose action to be taken to empower the diabetic patients so that they can improve their quality of life and increase survival.

What Participation Involves

The following will happen if you decide to participate in this study:

1.0 Your Weight, Height, Waist, hips and mid upper arm circumference will be measured

2.0 Also your blood pressure and fasting blood glucose will be measured

3.0 You will be asked questions and the results will be filled in a questionnaire with three main sections namely, demographic information, diabetes self care activities, and psychosocial distress.

Confidentiality

The researcher is assuring you that high standard of confidentiality will be observed in this study. No name of any participant will be mentioned in the report of this study. Only the statistics obtained will be used. All questionnaire and other study documents will be kept in a secure place and only the researcher and his associate in the project will gain access to the documents.

Risks

We do not expect that any harm will happen to you because of joining this study. Sometimes a small bruise may occur after obtaining sample for blood glucose test

Right to Withdraw and Alternative

Participation In Research Is Voluntary. You are free to decline to be in this study, or to withdraw from it at any point. Your decision as to whether or not to participate in this study will have no influence on your present or future status as a patient. Refusal to participate or withdraw from the study will not involve penalty or loss of any benefits to which you are otherwise entitled.

Benefits

There will be no direct benefit to you from participating in this study. However, the information that you provide may help health professionals better understand diabetic self care and psychosocial distress and may improve care given to people with diabetes.

You will receive no payment for your participation. Transportation costs will be reimbursed.

Incase of Injury

We do not anticipate that any injury will occur to you as a result of participating in this study. However if any physical injury resulting from your participation in this research should occur, we will provide you with treatment according to the current standard of care in Tanzania. There will be no additional compensations to you.

Who to Contact

If you ever have questions about this study, you may ask the researcher on the site or you may call the Principal investigator Mr. Rashidi Heri at 0744 272 080 or write to him through PO Box 65004, Dar es Salaam. If you have questions about your rights as a participant you may ask Prof. A. Y. Massele, Chairman of the College Research and Publication Committee of the Muhimbili University College of Health Sciences at PO Box 65001, Dar es Salaam, Tel 2150302-2

Consent Signing

If you agree to participate you should sign below.

I_____ have read and understand the contents in this form. My questions have been answered. I agree to participate in this study

Signature of Study Participant_____

Signature of Person Obtaining Consent_____

Date of signing the consent_____