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DIETARY ADHERENCE AND GLYCEMIC CONTROL AMONG PATIENTS WITH TYPE 2 DIABETES IN GA WEST MUNICIPAL HOSPITAL

BY

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DECLARATION

I hereby state that excluding precise references which have been duly acknowledged, the preparation and presentation of this MPH dissertation is my own original research under the superision of Dr Deda Alangea. This work has not been formerly presented to this or any other university for any degree. I am solely responsible for the views expressed and the factual accuracy of its contents.

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(Student)

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Dr. Deda Ogum Alangea Date

(Supervisor)

DEDICATION

1, Gloria Ama Ansah, dedicate this work to my parents Mr. and Mrs. Ansah for their wonderful support and to my sisters Rebecca and Sophia. God bless you all

ACKNOWLEDGEMENTS

I owe a never-ending debt of gratitude to my gracious and wonderful God for His grace and protection throughout my one-year programme and in the completion of this study.

Special thanks to my supervisor Dr. Deda Ogum Alangea who guided me diligently to ensure the quality of this work of which will be of maximum benefit to health authorities. I also express my sincere appreciation to the entire staff and heads of the Ga West Municipal Hospital for their understanding and cooperation during the data collection process.

Finally, to all my study respondents and colleagues, I do appreciate your time and efforts contributed. God bless you all.

ABSTRACT

Background: Globally, diabetes is one of the major health crises. Ghana has been considerably affected by the double burden of communicable and non-communicable diseases, including high incidence of diabetes. The high incidence of diabetes recorded globally can be attributed to unhealthy diets.

Objective: To assess dietary adherence and its association with glycemic control in adults with type 2 diabetes mellitus seeking treatment in Ga West Municipal Hospital

Methods: A total number of 140 participants were selected from the diabetic clinic in the Ga West Municipal Hospital using a convenience sampling method. Descriptive statistics such as means ± SD, Tables, Frequency and Percentage were used to describe dependent and independent variables. Chi Square test was used to find associations between the glycemic control and independent variables. Bivariate and multivariable logistic regressions were used to determine the strength of association between glycemic control and dietary adherence, sociodemographic characteristics, lifestyle factors and perceived family support. A confidence interval of 95% was used to show statistical significance.

Results: The percentage of participants with good glycemic control was 60% (n= 84). Majority of participants (74%) had good dietary knowledge. After controlling for the effect of age, sex, marital status, education, occupation and monthly income, lifestyle factors and family support, dietary adherence and referral to a dietician after being diagnosed with diabetes were found to be significantly associated with glycemic control. The odds of having good glycemic control was 12.3 times greater among respondents with good dietary adherence compared with those with poor dietary adherence (aOR=12.33, 95%CI: 3.64, 41.75; p<0.001). Respondents, referred to a dietician after being diagnosed with diabetes were 4.2 times more likely to have good glycemic control compared with those who were not referred (aOR=4.20, 95%CI: 1.47, 12.01; p=0.007).

Conclusion: Dietary adherence and referral to a dietician after diagnosis are significant predictors of good glycemic control among people with type 2 diabetes presenting at the Ga West Municipal Hospital.

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LIST OF ABBREVIATIONS

ADA - American Diabetic Association

CDA - Canadian Diabetes Association

CDE - Centre for Diabetes and Endocrinology

CVD - Cardiovascular Diseases

DM - Diabetes mellitus

DSME - Diabetes Self-management Education

ELISA - Enzyme Linked Immunosorbent Assay

FAO - Food and Agriculture Organisation

GDA - Ghana Diabetes Association

GDM - Gestational Diabetes Mellitus

GWMA - Ga West Municipal Assembly

GWMH - Ga West Municipal Hospital

HbA1c - Glycated Haemoglobin or Glycohaemoglobin

HIV - Human Immunodeficiency Virus

IDF - International Diabetes Federation

KAP - Knowledge, Attitude and Practices

MOH - Ministry of Health

NCDs - Non-Communicable Diseases

OGLAs - Oral Glucose-lowering Agents

OHAs - Oral Hypoglycaemic Agents

T2DM - Type 2 diabetes mellitus

WHO - World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Diabetes mellitus, commonly known as diabetes, in its distinct forms inflicts an excessively high human, societal and financial burden on nations at all income levels (International Diabetes Federation, 2017). Diabetes is a long-term condition due to elevated plasma glucose levels resulting from the body's inability to produce any or enough insulin or use insulin efficiently (DeFronzo et al, 2015). Insulin is a vital hormone in the conversion of plasma glucose into energy. The absence of insulin or inability of the beta-cells to appropriately respond to insulin leads to concentration of glucose in the blood, or hyperglycaemia, which indicates diabetes (IDF, 2017).

The World Health Organisation WHO categorises diabetes into three forms namely; type 1, type 2 and pregnancy induced or gestational diabetes mellitus (GDM) (WHO, 2016). Insulin dependent (type 1) diabetes, which occurs most often in children and adolescents is as a result of an autoimmune response where hyperactive immune system destroys the cells producing insulin hence, reducing insulin production. The determinants of type 1 diabetes are unidentified but a mixture of environmental, hereditary, and some dietary factors have been associated (You & Henneberg, 2016). Gestational diabetes mellitus is characterized by slightly higher blood sugar levels above normal observed during pregnancy (WHO, 2013). Though Gestational diabetes mellitus may occur at any stage of pregnancy, but it usually affects expectant mothers from thirteenth through to fortieth weeks of gestation (IDF, 2017).

Type 2 diabetes mellitus is a long-term condition characterised by persistently high blood sugar levels (hyperglycaemia) due to insufficient insulin production and inability of an individual to effectively metabolise blood glucose (WHO, 2016; IDF, 2017). Type 2 diabetes which is possibly preventable is mostly seen in older people, but incidence is steadily growing in children,

teenagers and young people due to increasing levels of obesity, poor diets and low physical activity (IDF, 2017).

Common indications of type 2 diabetes include thirstiness, blurred vision, frequent urination, lethargy, slow-healing sores, recurring fungal infections on the skin, and tingling or numbness in hands and legs (IDF, 2017). Other conditions related to diabetes include heart attack, stroke, kidney failure, vision loss and neural damage (Garber et al, 2013). However, symptoms are often less marked or absent; hence, majority of type 2 diabetes cases may go unnoticed for some number of years until when they present with a complication (IDF, 2017).

Globally, diabetes, cardiovascular disease, lung disease and cancer are among the top 10 causes mortality and accounts for more than 80% of all untimely non-communicable disease mortality. Type 2 diabetes makes up to 90% of all diabetes cases in older people and children globally with most cases living in developing countries (WHO, 2016). In 2015, approximately 70% of all deaths (40 million out of the 56 million deaths) recorded were caused by Non-Communicable Diseases (NCDs) (WHO, 2017). According to the same report, 1.6 million (4%) of the overall deaths were attributed to diabetes mellitus.

Sub-Saharan Africa continues to experience a growing occurrence of diabetes together with other chronic diseases (Hall et al, 2011). In Africa, almost 14 million adults had type 2 diabetes and over 298,160 deaths (6% of all death) were ascribed to diabetes. It is projected that by 2045 around 40.7 million adults in Africa will be living with diabetes, which is twice the number in 2017 (IDF, 2017). The WHO projects that by 2030, NCDs such as diabetes, will surpass infectious, nutritional, pregnancy-related and perinatal diseases as the major cause of mortality in Africa (WHO, 2011). In 2017, 518,400 Ghanaian adults had type 2 diabetes, representing roughly 4% of the adult population, which is expected to grow to nearly one million by 2045 (IDF, 2018).

Despite these statistics, only 1% of global healthcare expenditure is focused on diabetes in Africa as an investment to health systems strengthening and research with most healthcare expenditure mainly focusing on infectious diseases (IDF, 2017). With rapid urbanisation and aging populations, type 2 diabetes poses a rising threat. Even though the occurrence of type 2 diabetes is not well defined, it is strongly linkage with unhealthy lifestyle, aging, race and family history. The cornerstone of blood glucose control (glycemic control) in the management of type 2 diabetes is the adoption of a healthy lifestyle including the adherence to diet plans, cessation of smoking and increased exercise to keep healthy body weight (IDF, 2017).

The capacity to cope with Type 2 Diabetes Mellitus (T2DM) by following dietary recommendations will reduce deaths and complications like diabetic retinopathy, hypertension, stroke, kidney failure, peripheral arterial disease, amputation and loss of vision among people with T2DM (Shah & Mueller, 2012; Iunes et al, 2014; Sleiman et al, 2015). Even with this information, the management of diabetes in general continues to be challenging especially in resource limited countries including Ghana (Wagner & Brath, 2012).

The Ga West Municipal Hospital (GWMH) is the only serving referral health centre in the Ga West Municipality. GWMH has a clinic that serves people living with diabetes from the Municipality and other parts of the Greater Accra region. This research was hence geared towards examining the association between dietary adherence and glycemic control among patients with T2DM to inform measures focused on lessening the burden of the disease in this population.

1.2 Problem Statement

Globally, approximately 500 million individuals have diabetes and developing countries account for almost 80% of the disease burden (IDF, 2017). In Africa, an estimated 15.5 million adults live with diabetes and more than half (55.3%) of the proportion reside in the cities (IDF, 2017). In urban Ghana, the proportion of type 2 diabetes mellitus is 6% among adults and is likely to increase from half a million (500,000) in 2010 to around one million (1,000,000) by 2030 (Amoah et al, 2002; Shaw et al, 2010).

Early onset of T2DM may be due to risk factors like unhealthy diet, culture, family history of diabetes, lack of exercises, overweight and obesity, and smoking (Harding et al, 2014; Herman et al, 2015; FAO, 2010; WHO, 2015).

Persistently high blood glucose levels in T2DM leads to general damage to blood vessels leading to poor blood supply to major organs in the body (IDF, 2017). Findings from Yusuf et al. (2017) revealed that, virtually 90% of people who reported with nephropathy, retinopathy, neuropathy and cardiovascular diseases had high blood sugar levels (HbA1c $\geq$ 7).

To attain ideal blood sugar control, people with T2DM are required to follow a comprehensive management regimen of which diet therapy is a major constituent (IDF, 2017). A well-planned diet with the direction of a nutrition expert can significantly decrease plasma sugar levels in persons with T2DM (Wolf et al, 2004). Nevertheless, the influence of diet on glucose control heavily relies on the ability of the patient to adhere to the diet plans (Shah & Mueller, 2012; Iunes et al, 2014; Sleiman et al, 2015). Diabetes research in Ghana have mostly focused on the prevalence and risk factors related to T2DM including diet (Nawfal et al, 2017; Gatimu et al, 2016)

Yet, evidence on adherence to diet plan and its association with glycemic control among people with T2DM is lacking. This study seeks to examine the relationship between dietary adherence and glycemic control among patients with T2DM.

1.3 Justification

Chronic diseases including diabetes mellitus is linked to high morbidity and mortality and has serious effects on the social, economic and health system development globally and most especially in developing countries. In response to this global issue, the WHO published the Global Status Report on NCDs as a pathway for reversing the epidemic (WHO, 2010). The report includes the establishment of an alliance of national and global monitoring and surveillance system. The aim of the alliance is to decrease risk factors associated with chronic diseases by increasing the application of evidence-based methods in chronic disease research. Optimum glycemic control is the best way of reducing complications and enhancing the overall health of individuals with type 2 diabetes (Goose, 2014; Shogan & Levy, 2010). Thus, poorly managed diabetes has severe consequences on the health and well-being of patients (WHO, 2016).

Adherence to treatment plan including diet, medication, physical activity and other modifiable lifestyle as well as good motivation from family leads to improved glycemic control among T2DM patients (Bosi et al, 2013; Shawon et al, 2016; Mayberry & Osborn, 2012). Understanding patient's ability to adhere to dietary plans is therefore vital to inform treatment strategies and improve treatment outcomes. It will as well ensure improvement of dietary therapy approaches and policy formulation.

The aim of this study, therefore, was to examine the effect of dietary adherence in achieving optimum glycemic control among T2MD patients at Ga West Municipal Hospital in Accra.

1.4 Research questions

1. What is the level of knowledge on dietary recommendations for T2DM patients?
2. How well do T2DM patients adhere to dietary recommendations?
3. What is the proportion of glycemic control among T2DM patients?
4. What lifestyle factors are associated with glycemic control in T2DM patients?
5. What is the association between dietary adherence and glycemic control in T2DM patients?
6. How does perceived family support influence the association between dietary adherence and glycemic control?

1.5 General Objective

To assess dietary adherence and its association with glycemic control in adults with type 2 diabetes mellitus seeking treatment in Ga West Municipal Hospital

1.5.1 Specific Objectives

1. To assess the knowledge of patients on dietary recommendations for T2DM.
2. To identify lifestyle factors associated with glycemic control in T2DM patients
3. To examine the association between dietary adherence and glycemic control.
4. To examine how perceived family support influences the association between dietary adherence and glycemic control.

1.6 Conceptual framework

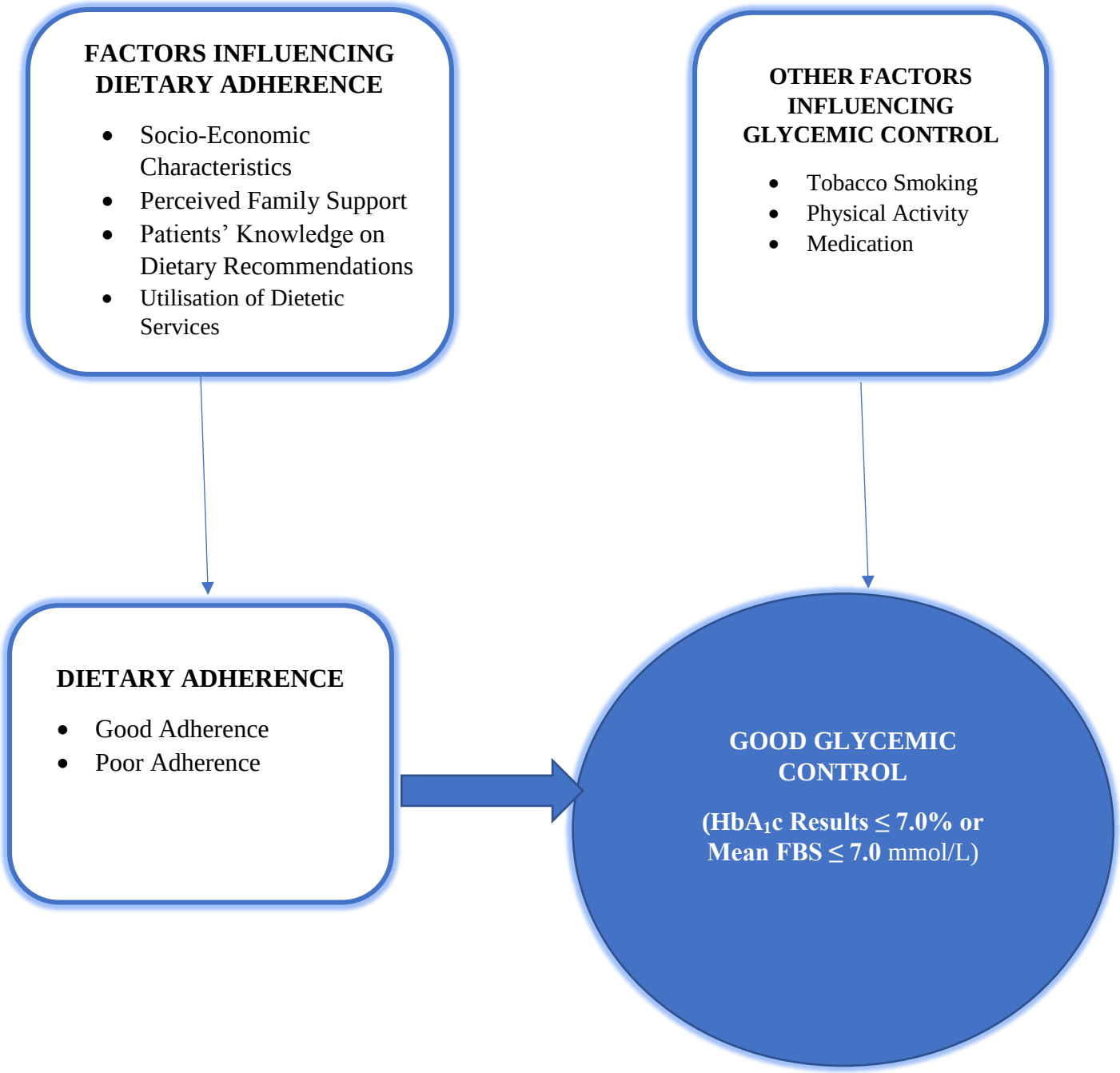

Figure 1.1: Conceptual framework showing factors influencing glycemic control among T2DM patients

Framework Narrative on Factors Influencing Glycemic Control

The conceptual framework in Figure 1.1 was created by the author based on existing literature. It presents the factors influencing dietary adherence and associated glycemic control among T2DM patients seeking healthcare at the Ga West Municipal Hospital.

Socio- demographic and economic characteristics such as employment status, level of education, marital status, age, income level, sex and religion to a large extent affect dietary adherence and glycemic control among T2DM patients (Nelson et al, 2015; Whitlock et al; WHO, 2011). Thus, patients knowledge on T2DM dietary recommendations is influenced by their level of education which also affects their ability to adhere or comply to dietary therapy (Cooke et al, 2015; Ryan & Deci, 2000) and affect their ability to achieve optimal glycemic (Gupta, Jain & Chauhan, 2017; Inzucchi et al, 2015). It is therefore more likely for patients with poor knowledge on dietary recommendations to default on dietary therapy and have poorer glycemic control, compared to patients with good knowledge.

Modification in patient's lifestyle such as smoking cessation, physical activity, utilisation of dietetic services and adherence to medication often depicts patient determination to control their glycaemic levels. In effect, glycaemic control could be hampered by patient's lifestyle choices (Danquah et al, 2012; Murray et al, 2013; OnKin et al, 2008)

Family support in the management of T2DM which includes diet modification influences the patients' ability to adhere to diet plans affecting the achievement glycaemic control (Shawon et al, 2016; Mayberry & Osborn, 2012).

In the nutshell, dietary adherence in people with type 2 diabetic mellitus is influenced by socio-economic characteristics, patient's knowledge diet recommendations and perceived family support. All of these factors have individual components, which all link up to influence the final output, which is glycemic control.

CHAPTER TWO

LITERATURE REVIEW

2.1 Burden of Diabetes Mellitus

Diabetes Mellitus is among one of the rapidly increasing chronic diseases worldwide. It occurs when there is a mixture of insulin resistance and failure in the discharge of insulin by pancreatic β-cells (Maahs & Mayer-Davis, 2010).

The burden of diabetes continues to rise globally as the proportion of people diagnosed with diabetes continue to grow. According to Wedel et al. (2015), the burden of diabetes globally has extremely increased over the past two decades and it is projected to affect more than 500 million people by 2030. Globally, the cases of diabetes have increased four-fold from 108 million in 1980 to 422 million in 2014 resulting in 4.6 million deaths in 2013 alone (Aschner et al, 2012). The incidence of newly reported cases of diabetes in United Kingdom (UK) was between 0.2% and 2.8% in people whose only risk factor was age over 45 (Lawrence et. al, 2001). Additionally, over 77 % of disease and 88 % of death associated with diabetes occur in low resource countries (Johnston et al, 2009; IDF, 2012). The incidence of diabetes in the United States was reported to be 33.9% in 2002 however it is projected that the occurrence of diabetes may increase to about 72% in the United States by 2050 (Boyle et al, 2010).

The burden of diabetes in Sub-Saharan Africa, is however compounded by the prevalence of other infectious diseases (Hall et al, 2011). The projections of diabetes in Africa is 1% and 5 to 7% in rural and urban areas respectively. It is however generally higher (8% and 13%) in urban areas. About one quarter (25%) of persons with diabetes at diagnosis, have indication of micro-vascular complications like retinopathy; the period of disease confirms that the exact inception of diabetes happens some years before it is clinically diagnosed (Wareham & Griffin, 2001).

The rate of diabetes mellitus in Ghana rose from 0.4% in 1958 to about 3% between 1988- 2000. Another study conducted in 2002 discovered that, the general prevalence of diabetes was 6.3% and was higher in males (7.7) than females (5.5) (Ghana Diabetes Association [GDA], 2000; Amoah et al, 2002). Between 1990 and 1997, Diabetes and endocrine disorder cases formed 6.3% of all admissions and 5.2% of all deaths in Korle-Bu Teaching Hospital, while 44% of amputation due to diabetes mellitus (Amoah et al, 2004; Naaeder, 1997). More than half of diabetics are unaware of their disease status and therefore do not receive any treatment (WHO, 2016).

2.2 Clinical manifestations and diagnosis of diabetes

Diabetes a prolonged metabolic disorder due to high blood sugar levels (or plasma glucose), which over a long time leads to severe damage of nerves and blood vessels in the kidneys, heart and eyes (WHO, 2018). Common symptoms associated with Diabetes Mellitus may consist of weight loss, blurring of vision and thirst. Most of the time, symptoms are not severe, or may be lacking.

The diagnostic criteria for diabetes have undergone some number of reviews and updates over the years but the present-day standards recommend that diabetes is established by detecting elevated levels of blood glucose. Diabetes must be diagnosed if following benchmarks are met (WHO, 2006);

Fasting blood sugar level ≥ 7.0mmol/L (126mg/dL) or,

2-hour blood glucose level ≥11.1mmol/L (200mg/dL) following a 75g oral glucose load or,

A random blood sugar level > 11.1mmol/L (200mg/dL)

2.2.1 Complications of Diabetes

Poorly managed or undiagnosed diabetes can cause complications like retinopathy, kidney failure, heart diseases, diabetes neuropathy or foot disease leading to amputation of lower limb due to poor healing of sores as well as premature deaths.

Retinopathy among diabetics is one of the main causes of blindness and visual disability. Blindness occurs due to damage of the minor blood vessels in the retina, leading to the loss of vision. That is type 2 diabetics stand a higher chance of becoming blind compares non-diabetics (CDC, 2012). Approximately 2% of diabetics develop blindness, while almost 10% develop severe visual disability after 15 years (Brownlee, 2005). Blindness as a result of certain types of cataract and glaucoma may be pronounced in persons with type 2 diabetes than non- diabetics (WHO, 2018).

Cardiovascular diseases contribute to nearly half (50%) of all mortality among persons with diabetes, especially those in developed countries (Lachin, 2008; Sarwar et al. 2010). Alcohol consumption, hypertension, high serum cholesterol, smoking and obesity are among risk factors for cardiovascular disease among persons living with type 2 diabetes (WHO, 2018). Diabetes is a major cause of renal failure, however its incidence differs among people and linked to the severity and duration of the condition. A number of methods to moderate progression of kidney damage in diabetics have been identified (WHO, 2018). They consist of optimal glycemic control, management of hypertension, drug therapy in prime stage of renal impairment, and limit intake of dietary protein. To prevent and effectively manage kidney disease among type 2 diabetics, screening and early diagnosis is crucial (US Renal Data System, 2014). Undoubtedly, neuropathy due diabetes is the most commonly reported complication of diabetes. Research shows that diabetic neuropathy affects about 50% of diabetes patients (Brownlee, 2005; Lachin, 2008). The main causes of this complication are the level and period of elevated blood glucose.

Sensory loss and damage to the limbs are some of the consequences of diabetic neuropathy and is usually the main reason for sexual weakness in men with diabetes (WHO, 2018). Diabetic foot disease, due to damaged nerves and blood vessels, usually leads to poor healing of wounds on the limb and amputation of limb. It is one of the most expensive complications of diabetes,

especially in societies with insufficient footwear. Amputation of the lower limb due to non-compliance to diabetes treatment regimen can be prevented by frequent examination and good foot care (Brownlee, 2005; Lachin, 2008; WHO, 2017).

According to Mbanya (2011), Diabetes Mellitus also worsens major communicable diseases like Tuberculosis (TB), HIV/AIDS and malaria. In developing countries where there is widespread of infectious disease, malaria and diabetes mellitus often occur together making treatment difficult resulting in high death rates among people with both conditions.

2.3 Social and Economic Burdens of Diabetes Mellitus

The World Economic Forum has constantly acknowledged non-communicable disease (NCD), including diabetes, as an international threat to businesses. National revenue losses from largely avoidable deaths due to conditions like diabetes mellitus, cardiovascular diseases and cancer are huge. Losses to national income due to Non-Communicable Diseases are estimated to reach 558 billion dollars in China, 303 billion dollars in Russia, and 237 billion dollars in India, hence more preventive efforts are needed to reduce this burden (IDF, 2007).

Disability and premature death are components of lost revenue. Disability associates with diabetes represents a strain on economic growth and development through losses in productivity, pushing families into poverty and depriving children of prospects for healthy living, education and future employment especially in resource limited countries where there are weak social protection policies. Diabetes is linked to poverty and obstructs human development. According to Kenya Diabetes Strategy (2010-2015) the cost of treatment and productivity loss undermines and inhibit economic growth. With a mean wage of one dollar per day for the low-income Kenyan, diabetes costs are way beyond their reach as priority is on food rather than medications. Therefore, there is the need for joint effort of various health care personnel in the treatment of

the several complications related to diabetes including diabetologists, ophthalmologists, prescribers, neurologist, physician specialist nurses, nutritionists and dieticians.

For effective treatment and management of diabetes, human capital and other resources such as equipment and instruments are equally essential. The equipment includes BP apparatus for measuring blood pressure, spectrophotometers for measuring glucose concentration in urine, and glucometer for measuring blood sugar levels. It is therefore important that, hospitals have facilities like diabetic clinic and trained health personnel to provide services to properly manage diabetes mellitus and its complications which unfortunately are inadequate in developing countries (Motala, 2010).

For effective treatment of diabetes, developing countries must strengthen their healthcare systems, improve distribution of medical resources including medicines to care for both infectious and non-communicable diseases, provide education on healthy lifestyles, improve delivery of preventive health care services as well as using patient registry system to improve documentation and patient follow ups (Motala, 2010).

For instance, in 1996, the Centre for Diabetes and Endocrinology (CDE) was launched in Eastern European countries to curb the shortage of trained endocrinologists/diabetologists and other health-care professionals.

South Africa have steered management of diabetes mellitus by putting adequate measures to ease the burden (Namukhula, 2015). Medical insurance schemes were set up in South Africa for the treatment and management of diabetes mellitus by mitigating the financial costs in the management regimen and financial incentives for health care providers to motivate them to improve diabetes care (Namukhula, 2015).

2.4 Knowledge of Patients on Dietary Recommendations for T2DM

Diet is gradually becoming one of the modifiable risk factors of chronic diseases, with scientific evidence continuously supporting the attestations that changes in dietary practices are strongly associated with health and wellbeing. Nutritional changes promote good health outcomes and prevents the development of chronic diseases like diabetes, cancer and heart disease as one ages (World Health Organisation, 2003).

Dietary knowledge is important because it plays an essential role in increasing awareness on good dietary practices and improving public health. Information on healthy eating and food safety can be inclining factors for improving dietary behaviours among diabetics (Alliance, 2011). Subsequently, acquiring knowledge on diet, adhering to it and increasing physical activity is crucial to maintain good glycemic levels and ultimately encourage a food conscious society and healthy living (Elhassan et al, 2013). It is estimated by Micha et al. (2017), that a relationship between dietary practices and mortality rate exists, thus, health institutions can augment the overall health and well-being in people with type 2 diabetes by refining their dietary habits.

Research by Wang et al. (2014) in Yakeshi, to examine nutritional knowledge, attitudes and practices among patients with type 2 diabetes established that diet is vital to glycemic control as confirmed by 75% of participants. It was also demonstrated by Gupta et al. (2015) that nutrition is an important component of diabetes care regime. A study carried out in Ethiopia 2012 to explore the association between poor dietary pattern among people with diabetes concluded that, poor nutritional knowledge and practices among the diabetics negatively affected their blood sugar levels (Ayele et al, 2012).

In another study carried out in the Khyber Teaching Hospital, patients' knowledge about diabetes control, causes and complications were found to be 34%, 69% and 39% respectively (Gul, 2010).

The level of knowledge on dietary adherence as a means of controlling blood glucose levels was very low among participants. A study by Ntaate (2015) to find the level of dietary knowledge among diabetes patients at Nasambaya health facility in Kampala concluded that, patients had good dietary knowledge and attitude towards diabetes management.

A Knowledge, Attitude and Perception (KAP) community study in Bangladesh to assess the level of dietary knowledge among members about diabetes mellitus found that, a lower proportion (41%) of the participants never knew anything about dietary therapy being an essential component in glycemic control (Islam et al, 2014). Knowledge on dietary modification in the control of diabetes and its complications among diabetics and the general public is very important. Creating public awareness about diabetes mellitus through well designed health programmes will improve knowledge and lessen the weight of the disease condition (ADA, 2014).

Evidence from the Saurashtra region, Gujarat showed that type 2 diabetics had little information about the diseases and its complications. The study concluded that participants who were on dietary therapy had good glycemic levels than being on only medication and exercise (Shah et al, 2009). Another study in India which intended to assess the dietary knowledge, attitude and practices among people with type 2 diabetes in Saurashtra region found that, about 50% of patients interviewed had good dietary knowledge about glycemic control (Kant & Thapliyal, 2015). According to Kant and Thapliyal, (2015) patients confused about the relationship between diabetes, diet, and insulin.

A personal diet plan recommended for all persons living with diabetes is an essential element of the whole treatment regimen for diabetes (ADA, 2012). According to Jacobson, et al. (2013), about 40% of daily energy intake from carbohydrate which includes fibre showed improved glycemic control among diabetics. Dietary fibre from fruits, vegetables, legumes, and

wholegrains is linked to lower mortality among people with diabetes hence dietary intake of 25 grams per day for older women and 38 grams per day for older men are recommended for persons with diabetes. About 20 to 30% of protein should be included in daily food intake. Foods rich in protein are chicken, meat, fish, nuts and legumes. Recommended total fat consumption for individuals with diabetes is 20–35% of daily food intake. Plant foods and fish are the most suitable sources of dietary fat. Sources are seeds, nuts, fish, avocado and olive oil (ADA, 2012). A study by Mohamed et al. (2013) to assess the eating patterns of Saudis living with type 2 diabetes and to relate them with the approved practices, reported poor dietary adherence among the participants. Also, Odenigbo & Inya-Osuu (2012) reported that non-compliance to dietary recommendations can lead to hyperglycaemia, macrovascular, microvascular and neural damage.

All the aforementioned studies indicated that people with type 2 diabetes in different regions had poor knowledge, attitudes and practices regarding nutritional management of diabetes mellitus. There is the need to assess patients' dietary knowledge on regulating blood sugar levels. The evidence can inform educational messages for improvement of dietary practices of DM patients for improved outcomes.

2.5 Adherence to Dietary Recommendations among T2DM Patients

Though healthcare provider support is important to ensure patient's compliance to treatment regimen, diabetes self-management is the vital to achieving optimal blood glucose control (Borgsteede et al, 2011). Adhering to treatment plan is an essential element to achieving treatment goals among individuals with diabetes. To achieve adherence, patients' behaviour or actions like taking medication, increasing physical activity and altering diet patterns should coincide with healthcare provider's guidelines (Vimalavathini, Agarwal, & Gitanjali, 2008). Effective management of type 2 diabetes requires a complete change in lifestyle including diet, exercise, and adherence to medication (Hertz, Unger & Lustik, 2005). However, people with

type 2 diabetes may have challenges complying to changes to diet, physical activity, and medication (Hertz et al, 2005).

Observing health care provider's guidelines about treatment regimen such as medications, dietary behaviours, exercise routines and regular hospital visits per year can improve blood glucose outcomes and prevent complications. However, adherence to management plans among individuals with type 2 diabetes is relatively low with about 36 to 94 percent adherence rate (Borgsteede et al., 2011). Several research have found that non-adherence was relatively high among young people, actively working diabetics and women (Hertz et al., 2005). Also, self-evaluation can help people with type 2 diabetes to adhere to dietary recommendations, select healthier diets, and "provide a means to deliver feedback on progress made in achieving dietary goals" (Servick et al, 2010). Therefore, diabetes self-management where patients play active roles in defining optimal glycemic goals for themselves is highly recommended (Ismail-Beigit et al., 2011).

The alteration of dietary behaviour must be centred on healthy food choices which is crucial for the present management of type 2 diabetes. The following are recommended guidelines for diet therapy among people living with type 2 diabetes (NICE, 2009; Evert et al, 2014; ADA, 2014):

- Diabetes patients should receive dietary counselling from a nutritionist or dietician with interest in diabetes. The counselling should be in a simple clear language and on paper dietary guidelines.
- Appropriate diet plan together with a physical activity routine must be recommended to reduce weight.
- Consumption of optimal diet with moderate calorie limitations
- Eat not less than 3-main meals a day and avoid excessive eating
- The diet plan should be designed based on personal and cultural preferences

- Consumption of complex carbohydrates
- Increase intake of diets high in fibre such as vegetables and fruits
- Avoid intake of polished sugars and products like fizzy drinks, chocolates or toffees. Simple sugars are easily absorbed into the blood stream leading to rapid rise in blood sugar hence, food containing simple sugars should be avoided by diabetics
- Sugar can be replaced with sweeteners (though not essential) without any serious problem.
- Avoid or reduce consumption of saturated fat (butter, egg yolk or lard) and substitute with vegetable oils, especially polyunsaturated fatty acids.
- Diabetics with or without hypertension, should limit intake of salt.
- Diabetics with renal complications should regulate protein and sodium intake.
- Avoid or moderate alcohol consumption.
- Avoid cigarette smoking.
- Vegetables or water, tea, coffee and drinks with little or no calories can be consumed with no restrictions.
- Encourage patients on Oral Glucose-lowering Agents (OGLAs) (for example sulfonylureas) or insulin to eat frequently to avoid the occurrences hypoglycemia.

2.6 Lifestyle Factors Associated with Glycemic Control

Diabetes self-management actions are very key to prevention of complications like blindness, kidney damage and leg ulcers. Unfortunately, patients do not act in accordance with recommendations even with its obvious benefits. Studies have shown that improved blood glucose levels, reduced cost of healthcare and reduced development complications, strongly relies on optimum diabetes self-care practices which includes patient's adherence to dietary recommendations and guidelines (Engler et al, 2013; NICE, 2009; ADA, 2013).

Sekhar et al. (2013) reported that, almost 60% of study participants were non-compliant to dietary plans and 63% of them were non-adherent to physical activity recommendations. This was evident as 50% of the participants had glycated hemoglobin above 7%. Lerman et al (2014), also showed that, only about 26% of diabetics in Mexico adhered to recommendations on diet plan, exercise therapy and medication. In another study by Tan et all (2011), only 16.4% of the study participants adhered to meal plans recommended for T2DM management.

According to Al-Sinani et al. (2010), 75% of the study respondents with type 2 diabetes in Oman reported poor dietary adherence. This was because participants had low awareness and lacked knowledge on the potential consequences of poorly managed diabetes mellitus. Another study reported inflexibility of diet plan, small portion sizes of food, cost and social care as barriers to adherence to dietary guidelines (Vijan et al, 2005). Nwanko et al (2010), established that, approximately (93%) of the research participant did not have any knowledge about simple diabetes care and only consulted a physician when complications begin to develop. Other studies have also demonstrated illiteracy, low knowledge, poor skills and unfounded beliefs as obstructions to adherence to diabetes management regimen (Mann et al, 2009; Islam et al, 2014; Lee et al, 2012)

Zhou et al. (2013) also demonstrated that, poor glycemic control due to poor adherence to treatment plans among people with type 2 diabetes may be due to low education. However, Hernanadez-Tejada et al. (2012) identified empowerment as a tool for improved adherence to diabetes self-management behaviour. Also, a study by Reichsman et al. (2009) revealed that, most patients with diabetes expressed challenges in adhering to prescribed treatments.

Mohebi et al. (2013) revealed difficulty of patients in complying with recommended dietary plans, and Schillinger et al. (2002), recognized a link between relationship between high health knowledge and its consequences on diabetes. The authors found that patients with low health

knowledge were expected to have poorly controlled glucose levels (HbA1c > 9.5%) than patients with adequate health knowledge. Diabetics have difficulty understanding and retaining practical information from healthcare providers due to poor communication styles (Kokonovic & Manderson, 2007; Kollannor-Samuel et al, 2012). Furthermore, Rustveld et al (2009), points out that patients with type 2 diabetes have difficulty in applying dietary information to manage their disease.

Absence of social support and inspiration were recognized as challenges to optimum diabetes self-management (Rosal et al, 2008; Elliot et al, 2013). Kiawi et al. (2006) identified low knowledge on the management of type 2 diabetes, inadequate care, poor dietary knowledge, unavailability of facilities and time constraints for physical activity, fixation on herbal medication, and belief systems as obstacles to poor glycaemic control.

Al-Kaabi et al. (2009) revealed that, low proportions of study participants (3%) complied with the recommendations on exercise. Reasons for non-adherence to physical activity guidelines where pain, time constraints, exhaustion, poor social support, disease condition, and weather conditions. Tiredness and lethargy were barriers found to prevent diabetic patients from engaging in physical activity (Rosal et al, 2008). Ozerch et al. (2013) also found barriers such as discomforts, dislike and interest in performing other tasks to exercise as the main causes of physical inactivity among participants.

In another study, around 60% of respondents were non-adherent to medication schedule (OHA) due to cost, drug side effects and self-medication with local herbs owing to patients' misconceptions about the efficacy of the recommended Oral Hypoglycaemic Agents (Yusuf et al, 2008). Brown et al. (2007), as well revealed that patients' preference for herbal medicine to physician instruction is attributed to patient's mistrust in the health care system. Abioye-Akanji (2013) also identified monetary problems, poor dietary pattern, preference for alternative

medicine, non-adherence to medication and poor healthcare provider interpersonal relations as reported barriers to adherence to medication.

A study by Peyrot et al. (2005) reported that, weaker health care systems threatens quality diabetes self-management. The negative health care provider attitudes toward individuals with type 2 diabetes, poor relationships with patients, and poor integration of health care services were identified causes of non-compliance (Lee et al, 2012; Bhojani et al, 2013). Another study by Raaijmakers et al. (2013), showed that people living with diabetes unawareness of healthy lifestyle programmes due to poor patient-provider communication. Parker et al. (2012) also identified time constraints, space, poor infrastructure and low staff strength as challenges to providing patients with information regarding healthy lifestyle activities. This has led to an unreliable provision of diabetes self-care interventions.

2.7 Association between Dietary adherence and Glycemic control

In Sub-Saharan Africa, type 2 diabetes mellitus contributes to more than 90% of the overall diabetes burden (Levitt, 2008) and is becoming predominant because of the upsurge of obesity, low exercise and rapid development (Levitt, 2008). T2DM is a dangerous condition which can lead to severe organ damage if left untreated and properly managed over a long time (ADA, 2014). To avert or delay the development of long-term complications, effective management of diabetes is paramount.

For individual with type 2 diabetes, the main goals of management of the condition are therefore; to coming back to normal improved metabolic processes, to achieve optimal glycemia and to reduce risk of developing diabetes-related complications. Effective diabetes management is also expected to encourage patients to properly control their glucose levels and promote healthy lifestyles (Abioye-Akanji, 2013). Helping people with type 2 diabetes to attain these intervention

goals requires some specific actions which include: self-care training, monitoring of plasma sugar level, taking medication, modification of dietary intake, physical activity and regular hospital visits (Nyenwe et al, 2011 and Evert et al, 2014). Adhering to these treatment recommendations are will significantly improve glycaemic levels, reduce complications associated with the condition and improve healthy living (Shrivastava et al, 2013).

Dietary therapy is an important factor in the treatment and prevention of T2DM (IDF, 2012). Diet therapy is a "nutritional diagnostic, treatment and counselling services for the aim of disease management". Diet therapy helps in establishing priorities and designing personal plans of action which enhance and support self-management obligation (Marrero et al, 2013). Because of the intricate nature of nutrition, patients are required to have a number of consultations with a dietician, where the expert provides a comprehensive diet care process for the patient (Evert et al, 2014). According to the ADA (2010), the purpose of medical nutrition therapy for diabetes are to;

- Attain ideal metabolic outcomes thus glycemic levels within normal range
- Reach optimum levels of lipids and lipoproteins
- Treat, delay and prevent complications linked to diabetes through changes in dietary patterns and behaviour.
- Diet plan should be based on individual preferences.
- Ensure dietary flexibility by restraining food choices based on scientific evidence.

Adherence to diet therapy leads to a continuous decline in glycemic level in people with type 2 diabetes mellitus (Funell et al, 2011). Diet therapy is also known to improve health status among diabetics and reduces the cost associated with its management (Institute of Medicine, 2000). Even with the significant benefit of nutrition therapy in diabetes management, it is by far the

most challenging and difficult component of diabetes self-management. Most often, steps taken by diabetics to adhere dietary recommendations leads to undesirable lifestyles (Asif, 2014).

The ADA recommends that carbohydrates should provide 50 to 60, protein should provide 15 to 20% and fat should provide 10 % of total energy intake among type 2 diabetics (ADA, 2004). Nyenwe et al. (2011) also suggested that, the diet plan for patients with type 2 diabetes should include 50-60% of daily energy intake from carbohydrates, 15-20% from protein and less than 10% from fats. However, studies have shown that, there is no one particular diet plan for all type 2 diabetes patients and growing evidence suggest that combination of different dietary therapies improves achievement of optimal glycemic control (Wheeler et al, 2012; Evert et al, 2014). The principles of dietary management in diabetes also confirmed that there is no perfect amount of macronutrients intake for people with type 2 diabetes mellitus to enhance glycemic control however, consumption of complex carbohydrates and high fibre foods such as whole grains and cereals, vegetables, fruits, and legumes is highly recommended for individuals with type 2 diabetes (WHO, 2003; ADA, 2014). This recommendation is in line with the newly revised guidelines for the management of (ADA, 2014).

Although the recommendations on ideal intake of macronutrients in terms of proportions or distribution to attain optimal blood glucose control is varied, diet plans should be personalised with regards to availability and accessibility to food, cultural attachment, glycemic target and should be based on standard nutrition guidelines for the general public (IDF, 2017; Bantle et al, 2008;). Furthermore, the amount and type of macronutrient as well as the overall caloric consumption must be of utmost concern regardless of personal preferences or eating habit (ADA, 2014).

2.8 Perceived Family Support Influence on Dietary Adherence and Glycemic Control

Poor glycemic control in people with type 2 diabetes is often linked to severe multiple long-term complications, including damage to blood vessels, kidney and visual nerves as well as peripheral neuropathy and cardiovascular diseases (Long, & Dagogo-Jack, 2011). Factors associated poor glycaemic control in T2DM patients include unhealthy dietary behaviour, low physical activity, poor adherence to medication, and poorly monitored blood glucose levels (Choi, 2009).

Managing Diabetes Mellitus (DM) is crucial in preventing the development of complications and improving the quality of life among type 2 diabetics (Shrivastava et al, 2013). The American Diabetes Association (ADA) stated that, diabetes self-management education (DSME) is the bases for good diabetes management. DSME is very important because management of T2DM is multifaceted. Patients are required to perform a number of tasks including; regular hospital visitations, comply with medication regimens and take part in healthy self-care behaviours including home-based blood glucose monitoring, healthy eating habits, and increased exercise (ADA, 2013). However, it is usually challenging for diabetics to regularly engage in healthy lifestyle behaviours essential for optimum glycemic control. Normally reported barriers include challenging daily demands, emotional distress, and low commitment (Tong, Vethakkan & Ng, 2015). Also, poor knowledge, low self-confidence to effectively perform an activity, and lack of family support has been linked with poor diabetes self-care (Miller & Dimatteo, 2013). Other studies reported that poor social support negatively affect patients' self-care actions (Miller & Dimatteo, 2013; Wong-Rieger & Rieger, 2013).

Since people with T2DM live within families and bigger communities, these factors can also affect a patient's diabetes self-care activities. The Family is key source of emotional and physical support. Support includes assisting patients to perform specific tasks like booking medical appointments or aiding with insulin shots whereas emotional support includes providing comfort

and reassurance when patients face challenges with the extensive management of the disease condition (Baig et al, 2015). Realising the impact family can have, management of diabetes should include the delivery of diabetes education for family members or integrate family support as a component of the patient's diabetes management plan.

Although the importance of family support in diabetes care is usually discussed, few detailed researches have explicitly examined this problem in the Ghanaian context. Therefore, this study aims to review family support interventions and diabetes-related outcomes among patients with T2DM.

CHAPTER THREE

METHODOLOGY

3.1 Research Design

This study used a descriptive cross-sectional design using quantitative methods to determine how adherence to dietary recommendations affects glycemic control in adults with type 2 diabetes mellitus.

3.2 Study Area

The study was conducted at the Ga West Municipal Hospital (GWMH). The GWMH is located in the Ga West Municipality. The 2018 projected population of Ga West Municipality is about 219,788 with a growing rate of 3.4%. The relatively high growth rate is because of the closeness of the municipality to the nation's capital city, Accra, where there is a lot of migrant workers (Ghana Statistical Services, 2014). The Ga West Municipality shares common boundaries with Akuapem South to the North, Ga East and Accra Metropolitan Assembly to the East, and Ga South to the south and West. It occupies a land area of around 305.4 square kilometres with about 193 communities (GSS, 2014). The hospital is surrounded by good road networks, making the hospital the major referral points to other health centres located in the municipality. The

diabetic unit of the hospital manages patients with type 1 and 2 diabetes. The hospital holds diabetic clinics weekly for patients on Wednesdays.

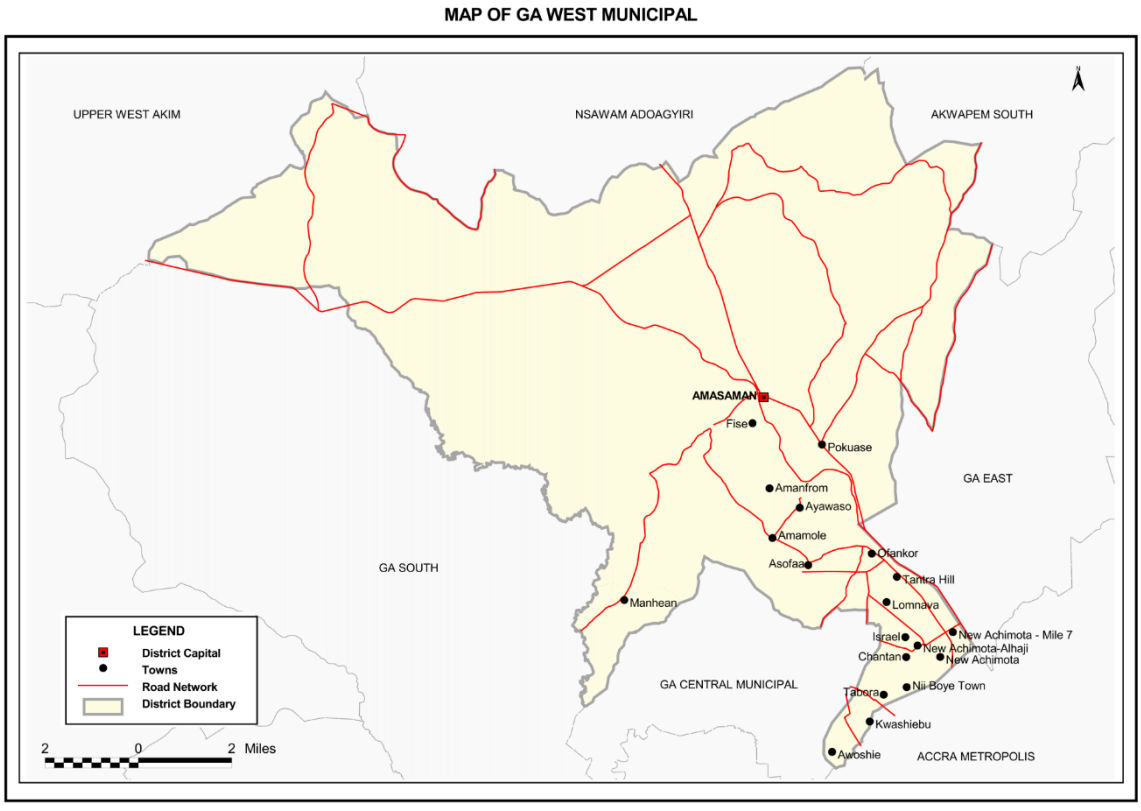

Figure 3.1: **Map of Ga West Municipal Hospital (Source: GSS, 2010)**

3.3 Study Population

Both male and female adult patients with type 2 diabetic mellitus seeking healthcare at the diabetic clinic of the Ga West Municipal Hospital were enrolled in this study. T2DM patients were identified by using patients' folders where medical physicians have confirmed diagnosis of the condition using consistently high Fasting Blood Sugar (FBS) results greater or equal to 126 mg/dL (7.0 mmol/L) and RBS results greater or equal to 200 mg/dL (11.1 mmol/L).

3.3.1. Inclusion criteria

- All patients with type 2 diabetes aged 30 years of age and above.
- Participants on medication for at least six months and receive services at the diabetic clinic.
- Participants with glycated haemoglobin laboratory test or three consecutive fasting blood sugar (FBS) measurements not later than three months prior to study.

3.3.2. Exclusion Criteria

- Patients with cognitive impairment and cannot give consent
- Pregnant women with diabetes
- Non- ambulatory T2DM patients

3.4 Study variables

The variables considered in this study are described below.

3.4.1: Dependent variable

Glycated/glycosylated haemoglobin (HbA1c) or mean fasting blood sugar (FBS) measurement of participants was the dependent variable for the study. As used in this context, HbA1c or mean FBS result of a participant is the glycated haemoglobin laboratory test or three consecutive fasting blood sugar measurements of participants found in their folders or within their

possession. The results of HbA1c or FBS were expressed as a percentage or in units of mmol/mol and mmol/L. Results not older than three months was used in the study.

HbA1c categorization was done by organising participants with values of 7.0% and below as good glycemic control and values above 7. 0% as poor glycemic control. HbA1c was measured on a ratio scale of measurement (percentage count).

FBS categorization was done by using the mean FBS of respondent's three consecutive FBS measurement not older than three months. Mean FBS values below 7.0 mmol/L were categorised as 'good glycemic control' and mean FBS values of 7.0 mmol/L and above were categorised as 'poor glycemic control'. The mean FBS was also used in the absence HbA1c test results to assess glycemic control among participants. This is because, FBS test is relatively cheaper and readily available at the hospital's laboratory compared to glycated haemoglobin (HbA1c) test which also required a referral outside the health facility. As such, physicians in the hospital usually rely on FBS in the assessment and monitoring of glycemia in diabetic patients.

3.4.2: Independent Variables

The outcome of this study was reliant on some key independent variables which comprised of dietary adherence, family support and patient's knowledge on dietary recommendations.

Demographic characteristics of participants such as age, sex, marital status and religion as well as Socioeconomic factors (Income, Education, Occupation) were also explored. Participants' information on duration of disease and complications were also assessed. Information about participants' lifestyle such as tobacco smoking, alcohol consumption, physical activity level, utilisation of dietetic services and medication adherence were also collected.

The independent variables are as described in Table 3.1.

Table 3.1: Description of Study Variables

VARIABLE	MEASUREMENT SCALE	MEASUREMENT
Marital Status	Nominal	1= Single/ Separated/Widow/widower; 2= Married
Physical Activity Level	Ordinal (composite)	1 = Low; 2 = Medium; 3 = High
Age	Numeric (Discrete)	Count (age at last birthday in years)
Sex	Nominal	1= Male; 2 = Female
Knowledge on dietary recommendations	Ordinal (composite)	1 = Poor; 2 = Good
Medication Adherence	Ordinal (composite)	1 = Low; 2 = Medium; 3 = High
Dietary Adherence	Ordinal (composite)	1 = Poor; 2 = Good
Income	Ordinal	1 = less than Gh¢200; 2= From Gh¢200 - Gh¢499; 3 = Gh¢500 - Gh¢999/Gh¢1,000 - Gh¢1,999/Gh¢2,000 - Gh¢3,999/Gh¢4,000 & over per month
Occupation	Nominal	1 = Unemployed/ Retired; 2 = Manger/Professional/Skilled/Agricultural/Sales and Services
Religion	Nominal	1= Christianity; 2 = Islam;
Education	Ordinal	1= No formal education; 2 = Elementary /JHS; 3 = SHS/Secondary/ Vocational/ Technical; 4= Tertiary Education
Duration of disease	Ordinal	1 = 20years and above; 2 = 10 – 19 years; 3 = 5 – 9 years; 4 = 2-5 years; 5 = Less than a year

Complications	Nominal	1= Hypertension/Retinopathy/Neuropathy/ Cardiovascular disease/Chronic Kidney Disease/Diabetic Sores/Hypoactive sexual arousal; 2= No complication
Perceived Family Support	Ordinal (composite)	1 = Low; 2 = High
Tobacco Smoking	Ordinal	1 = Yes; 2 = No
alcohol	Ordinal	1= Every Day/< 3 times a week/ Few times in a month/year; 2= Not at all
Referred to a Dietician	Ordinal	1 = No; 2 = Yes
Miss dietician appointment	Ordinal	1 = Yes; 2 = No
Last visit to a dietician	Ordinal	1= One month ago; 2= Two months ago; 3= More than six months; 4= More than three months

3.5 Sample Size Determination

Using the sample size formula by Yamane (1967) for cross-sectional study:

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

Where: n = corrected sample size

N = Total population = 200 (GHS DHIMS report, 2017).

e = Margin of error set at 0.05**.**

$$n = \frac{200}{1+200(0.05)^2}$$

$$n = \frac{200}{1.5} = 133$$

The sample size considering a 5% non-response rate is 140 of type 2 diabetes patients.

3.6 Sampling Procedure

A convenience sampling method was used in the study where willing patients who fell within the inclusion criteria were enrolled onto the study till the estimated minimum sample size was exhausted.

3.7 Data Collection and Tools

Dietary Adherence: Assessment of dietary adherence was done by using the UK Diabetes and Diet Questionnaire (UKDDQ) which is a short, reliable and valid diet evaluation instrument (England et al, 2017). Specific food items in the original questionnaire was modified to evaluate food consumption by taking into account the type of food, the frequency of intake and amount taken (demonstrated by portion size pictures). Questions 23 to 25 of the original questionnaire (UKDDQ) was taken out since they were for evaluated weight concern. The remaining 22 out of the 25 questions were used for the study. Participants were asked to select the frequency of intake of different food items from different food groups over the last month. Participants were given different options to choose from thus; 'never or very rarely', 'once a week or less often', '2-4 times a week' and '5 – 6 times a week or every day'. Participants were scored using the UKDDQ scoring protocol by assigning a matching letter in relation to the selected answer for frequency of intake ranging from an A (good adherence) to D (poor adherence). For data analysis, answers from each of the questions were re-coded into numerical values using the following codes: A=1, B=2, C=3, D=4. The mean UKDDQ score for each participant was then calculated leading to scores ranging from 1 to 4 with an intention that lower scores reflected good dietary adherence and higher scores reflected poor dietary adherence.

Physical Activity: Assessment of physical activity among study participants was done using the short form of the International Physical Activity Questionnaire (International Physical Activity Questionnaire, 2002) over the last 7 days. The questionnaire is made up of 7 open-ended

questions about an individuals' last 7-day recall of physical activity. Based on the scores, physical activity levels were categorized into low, moderate or high physical activity. A score of '1' reflects low physical activity, a score of '2' reflects moderate physical activity and a score of '3' reflects high physical activity.

Medication Adherence: Medication adherence among participants was assessed using the Morisky Medication Adherence Scale (MMAS) (Morisky et al, 1986). The Morisky scale is a valid scale designed to evaluate medication adherence and scores are based on participants answers to four, 'Yes' or 'No' questions where yes=0 and no=1. Level of medication adherence was categorized into high, medium and low depending on whether or not the participants defrauds in taking their medication according to prescribed. A score of zero places one under low medication adherence; a score of 'one' or 'two' places one under medium adherence and a score of 'three' or 'four' places the individual under highest level of medication adherence.

Patient's knowledge on dietary recommendations for T2DM: Participants knowledge on dietary recommendations for the T2DM was assessed using a validated Audit of Diabetes Knowledge (ADKnowl) questionnaire (Speight & Bradley, 2001). The original questionnaire contained 27 item sets relating to treatments regimen. This study used the two diet-specific subsections (section 11 and 12) of the original questionnaire totalling seventeen (17) questions that were applicable to all T2DM participants. Knowledge scores were calculated as a percentage of questions answered correctly out of all the 17 questions with a percentage score ranging of 0–100%. For the purpose of this study, scores 50% and above were classified as good knowledge and scores below 50% was classified as poor knowledge.

Perceived Family Support: Level of perceived family support was assessed using the Diabetes Care Profile questionnaire developed and validated by the University of Michigan Diabetes Research and Training Centre (Fitzgerald et al, 1998). The "Family Support" section (section V) of the original questionnaire was used in this study. The "Family Support" section is made up of

13 questions with 5 Likert-type responses; Strongly Disagree, Somewhat Disagree, Neutral Somewhat Agree and Strongly Agree. Responses were scored by following the Diabetes Care Profile Scale scoring protocol by providing a corresponding number relating to the chosen answer of the 5 Likert-type responses. A 'strongly disagree' response was scored '1', 'somewhat disagree' response was scored as '2', 'neutral' response was scored '3', 'somewhat agree' response was scored '4' and 'strongly agree' response was scored '5'. Reverse score was given to questions 8,10 and 12. The total mean family support score was calculated by using the Diabetes Care Profile Scale Formulae where all responses by each participant was divided by the number of questions asked with mean scores ranging from 1 to 5. A score of 1, 2, 3 reflect low family support and a score of 4 or 5 reflect high family support.

The study questionnaire was divided into seven sections. Section A collected information on socio-economic status (age, religion, marital status, estimated monthly income, level of education and religion) and disease information (duration of diabetes, complications and HbA1c/FBS test values) of study participants. Section B collected information on lifestyle factors (smoking, alcohol consumption and utilization of dietetic services). Section C collected data on knowledge on dietary recommendation for T2DM. Section D collected data on medication adherence and section E collected information on family support. Section F and G collected information on physical activity and frequency of food intake respectively.

Selected participants on each day were approached for consent to participate in the study. Study objectives were explained to them and a written consent was obtained for all willing participants before study questionnaire was administered

The results of HbA1c or three consecutive FBS tests not older than 3 months were obtained from the folders of study participants. Interviews were conducted during the Diabetic Clinic days (Wednesdays) and at the diet therapy unit of GWMH from May to June 2019. Study participants

were recruited at the diabetic clinic, but actual interviews took place at secluded place within the hospital to ensure privacy.

3.8 Quality Control

Two research assistants were selected and trained to assist in data collection to ensure consistency and accuracy. The content of the training included; objective of the study, interviewing skills, hospital entry ethics, translation of questionnaire into various local languages, confidentiality and assurance of privacy during interviews. The principal researcher led the team during the entire questionnaire administration to ensure that relevant information in line with the objectives of the study are captured. The questionnaires were checked for errors and completeness before final entry into appropriate software (Microsoft excel) and exported to STATA version 15 for statistical analysis.

3.9 Pretesting

There was pretesting of questionnaires among people with type 2 diabetes in a different health facility with comparable patient characteristics. Pretesting of the data collection tools was done at the Nsawam Government Hospital with 10 participants to validate the survey tools. The purpose was to establish clarity of questions asked, appropriateness of the order of questions, adequacy of response options provided, the need for additional or removal of existing questions to ensure that relevant data is collected. After pretesting, the principal researcher checked the completed questionnaires to ensure that responses were recorded correctly by the research assistants. All inconsistencies in recording sighted were amended and reviewed with all research assistants before actual commencement of the study.

3.10. Data Analysis

Quantitative data were coded and entered into excel, and further imported into STATA 15 for statistical analysis. Descriptive statistics (bar graph, pie charts, frequency tables, etc.) were used to summarize and present data on dependent and independent variables. Chi Square (X^2)

statistics was also used to find associations between the dependent variable (glycemic control) and background characteristics, lifestyle factors and dietary adherence.

To ensure that the independent variables fit into the logistic regression model, categories of some variables were further collapsed. Under marital status, 'single/separated/widow or widower' were put together as 'Not married'. With occupation, 'Retired' and 'Unemployed' was put together and labeled as 'Unemployed' and 'managers/professionals/sales and services/agricultural worker' was put together and labeled as 'Employed'. Categories under education were also collapsed as follows: 'Elementary/JHS' was put together and labeled as 'Basic education' and 'SHS/tertiary' was labeled as 'SHS & above'. With monthly income, 'Gh¢500 -999/Gh¢1,000-1,999' was put together and labeled as 'Gh¢500 & above'. Alcohol consumption was categorized as 'Yes' or 'No' with 'Every Day/< 3 times a week/Few times in a month or year' representing 'Yes'. Physical activity was categorized as 'Low' and 'High' with 'Medium/High' representing 'High'

A binary logistic regression was used to test the association between the outcome of interest (glycemic control) and socio- demographic characteristics, alcohol consumption, referral to dietician, physical activity, medication adherence and perceived family support.

To determine the strength of association between dietary adherence and glycemic control, a multiple logistic regression was used adjusting for socio-demographic characteristics (age, sex, marital status, education, occupation, monthly income), alcohol consumption, referral to a dietician, physical activity, medication adherence and perceived family support. A confidence interval of 95% was used to show significant relations between the dependent and the independent variables.

3.11. Ethical Consideration

Ethical issues involved in the study were addressed by doing the following.

3.11.1. Ethical Clearance

To ensure that ethical issues were properly addressed in this study, an approval was obtained from the Ethical Review Committee of the Ghana Health Service (GHS), Research and Development Division, Accra. The approval was duly obtained before the study was conducted. The head of the Population, Family and Reproductive Health department of the School of Public Health (SPH) issued a letter of introduction that was sent to the head of the hospital and the Municipal Health Director of the Ga West Municipal Health Directorate for permission to conduct the study. Afterward, a template of the letter certified by Ghana Health Service Ethical Review Committee (GHS-ERC: 013/03/19) was also sent to the authorities.

3.11.2. Potential Risks/Benefits

The research involved only the administration of questionnaire and collection of information on Glycated Haemoglobin values or Fasting Blood Sugar Level values from participants' folders which are questions routinely asked during dietary consultations and did not expose participants to any additional risks. Participants in the study were not given any material benefits for the study. They were informed that they will benefit if policies are put in place to improve upon existing measures of managing type 2 diabetes patients or to enforce existing ones with the objective of better improving diabetic control for patients.

3.11.3. Privacy/Confidentiality

Participants were interviewed one at a time in an "unused" consultancy room within the hospital to ensure privacy. Confidentiality of information collected was ensured by using codes rather than names of participants and data was kept under lock and key. Data collected were used only for the purpose of this project and only accessible to the principal investigator and supervisor.

3.11.4. Data Storage and Usage

All hard copies of information collected were transformed into an electronic data using Microsoft Excel 2013 with an encrypted password. The research instrument (questionnaire) and

the electronic data will be stored for at least five (5) years. Participants were guaranteed that information collected will only be used for academic purposes and synthesised for evidence-based policy formulation.

3.11.5. Voluntary Withdrawal

Participants were informed that participation in the research was entirely voluntary, that they had the right to either be or not be part of the research and withdraw consent or discontinue participation in the research at any time without prejudice from the research team or hospital staff.

3.11.6. Compensation

Participants were not provided with any reward/compensation for participation.

3.11.7. Declaration of Conflict of Interest

The principal investigator has no potential conflict of interest with regards to this research including the supervisor or any of the research assistants recruited to partake in the study. This work is purely for academic purposes.

3.11.8. Funding Information

The research was fully funded by the principal investigator.

CHAPTER FOUR

RESULTS

4.0. Introduction

This Chapter presents the findings on dietary adherence and its association with glycemic control in adults with type 2 diabetes mellitus seeking treatment at the Ga West Municipal Hospital. Outlined in the various sub-sections are participants' social and economic characteristics, knowledge on dietary recommendations for T2DM, dietary patterns, perceived level of family support and associations between all these variables and glycaemic control.

4.1. Background Characteristics of Study Participants.

A total of 140 participants participated in the study with females being in the majority (71%). The mean age of the participants was 52.26 ± 11.84 years with a minimum age of 30 years and maximum age of 78 years. About half (50.7%) of all study participants were married. Christians constituted a greater majority of the study participants (91.4%).

Over 80% of respondents reported income levels less than Gh¢500.00 a month and over 60% have had up to elementary level education. The reported occupation of respondents generally touched on all categories ranging from managerial positions through professional/skilled worker to services and sales. However, 56% of the participants reported service and sales as their main form of occupation.

Findings on disease condition show that most study participants (78%) had lived with T2DM for over 2 years. While 69% of participants reported they had hypertension, 28% reported no disease complication. Other details on participant's sociodemographic and economic characteristics are shown in Table 4.1.

Table 4.1: Background characteristics of study participants (N=140)

Variables	Number	Percentage (%)
Age in years		
30-39	22	15.71
40-49	21	15.00
50-59	57	40.71
60-69	32	22.86
70 & Above	8	5.71
Sex		
Male	32	22.86
Female	108	77.14
Marital Status		
Married	71	50.71
Single	12	8.57

Separated	27	19.29
Widow/Widower	30	21.43
Level of education		
No formal education	39	27.86
Elementary	48	34.29
JHS	24	17.14
SHS Education	15	10.71
Tertiary Education	14	10.00
Religion		
Christianity	128	91.43
Muslim	12	8.57
Occupation		
Managers	5	3.57
Professional/Skilled	33	23.57
Retired	21	15.00
Agricultural	2	1.43
Service and Sales	65	46.43
Unemployed	14	10.00
Estimated Income Level		
< Gh¢200	87	62.14
Gh¢200 - Gh¢499	38	27.14
Gh¢500 - Gh¢999	12	8.57
Gh¢1,000 - Gh¢1,999	3	2.14
Duration of Disease		
Within a year	50	35.71
2 to 5 years	63	45.00
5 to 9 years	15	10.71
10 to 19 years	8	5.71
20 years and Above	4	2.86
Disease Complications		
Hypertension (High BP)	96	68.57
Neuropathy (Nerve disease)	4	2.86
No disease complications	40	28.57

4.2. Glycemic Control among People with T2DM Presenting at the GWMH

The study examined glycemic control among study participants. In all, 60% of study participants had good glycemic control indicated by glycosylated haemoglobin (HbA1c) or mean fasting blood sugar (FBS) less than 7.0% or 7.0mml/L respectively.

4.3. Association between Background Characteristics and Glycemic Control among people with T2DM presenting at the GWMH

The study examined the association between socio-economic characteristic and the outcome of interest (glycemic control) among study participants. A chi-square analysis was run comparing each socio-economic characteristic with glycemic control. The results are in Table 4.2 below. The analysis shows that, none of the socio-economic variables were significantly associated with glycemic control.

Table 4.2: Association between background characteristics and glycemic control among people with T2DM presenting at the GWMH

Variables	Good Glycemic Control (%)	Poor Glycemic Control (%)	Chi Square Value	P-Value
Age in years			6.19	0.185
30-39	16 (19.05)	6(10.71)		
40-49	15(17.86)	6(10.71)		
50-59	28(33.33)	29(51.79)		

60 & above	25(29.76)	15(26.78)		
Sex			0.01	0.935
Male	19(22.62)	13(23.21)		
Female	65(77.38)	43(76.79)		
Marital Status			1.18	0.758
Married	40(47.62)	31(55.36)		
Single/ Separated/ Widow/ Widower	44(52.28)	25(53.57)		
Level of education			2.51	0.643
No formal education	24(28.57)	15(26.79)		
Elementary/ JHS	44(52.39)	28(50.00)		
SHS/ Tertiary Education	16(19.04)	13(23.21)		
Religion			1.16	0.280
Christianity	75(89.29)	52(94.55)		
Muslim	9(10.71)	3(5.45)		
Occupation			1.59	0.901
Managers/Professional/Skilled	23(27.38)	15(26.79)		
Retired/ Unemployed	22(26.19)	13(23.21)		
Agricultural	1(1.19)	1(1.79)		
Service and Sales	38(45.24)	27(48.21)		
Estimated Income Level			2.88	0.410
< Gh¢200	54(64.29)	33(58.93)		
Gh¢200 - Gh¢499	24(28.57)	14(25.00)		
Gh¢500 - Gh¢999	5(5.95)	7(12.50)		
Gh¢1,000 - Gh¢1,999	1(1.19)	2(3.57)		
Duration of disease				
Within a year	20 (35.71)	30 (35.71)	2.05	0.561
2 to 5 years	24 (42.86)	39 (46.43)		
5 to 9 years	5 (8.93)	10 (11.90)		
10 to 20 years and Above	7 (12.50)	5 (5.95)		
Complications			3.64	0.056
Hypertension/Neuropathy	45 (80.36)	55 (65.48)		
No complications	11 (19.64)	29 (34.52)		

4.4. Association between Lifestyle Factors and Glycemic Control among people with T2DM presenting at the GWMH

The study collected information on lifestyle factors such as tobacco smoking, alcohol consumption, utilization of dietetic services, medication and physical activity. From the analysis, none of the study participants smoked tobacco and 81% of them did not consume alcohol at all.

With regards to dietetic services, 69% of participants reported to have been referred to a dietician since they were diagnosed. However, 26% of those who saw a dietician reported that they sometimes miss appointment with their dietician. More than half (55%) of the study participants reported high adherence to medication with only 10% reporting low medication adherence. Over half of the study participants (51%) were found to be physically inactive.

To determine the association between relevant lifestyle characteristic and glycemic control, X^2 statistics was explored comparing each of the lifestyle variable with glycemic control. Results in Table 4.4 shows that only 'referred to a dietician after diagnosis' (X^2 (1) = 26.630, p<0.0001) was significantly associated with glycemic control. All other factors (smoking, frequency of alcohol consumption, miss dietician appointment, last visit to a dietician, medication adherence and physical activity) were not significantly associated with glycemic control.

Table 4.4: Association between lifestyle factors and glycemic control among people with T2DM presenting at the GWMH

Variables	Good Glycemic Control (%)	Poor Glycemic Control (%)	Chi Square Value	P-Value
Smoking				
Yes	0(0.00)	0(0.00)		

No	84(100.00)	56(100.00)		
Frequency of Alcohol Consumption			2.26	0.322
Every Day	0(0.00)	0(0.00)		
< 3 times a week	4(4.76)1	1(1.79)		
Few times in a month/year	10(11.90)	11(19.64)		
Not at all	70(83.33)	44(78.57)		
Referred to a dietician after diagnosis			**26.63**	**<0.0001**
Yes	72(85.71)	25(44.64)		
No	12(14.29)	31(55.36)		
Miss dietician appointments			0.53	0.463
Yes	29(40.28)	8(32.00)		
No	43(59.72)	17(68.00)		
Last visit to the dietician			5.25	0.154
One month ago	6(8.33)	5(20.00)		
Two months ago	9(12.50)	6(24.00)		
More than three months	14(19.44)	4(16.00)		
More than six months	43(59.72)	10(40.00)		
Medication Adherence			0.33	0.848
High	44(52.38)	32(57.14)		
Medium	31(36.90)	19(33.93)		
Low	9(10.71)	5(8.93)		
Physical Activity			1.57	0.456
High	7(8.33)	3(5.36)		
Medium	32(38.10)	27(48.21)		
Low	45(53.57)	26(46.43)		

4.5. Knowledge on Dietary Recommendations for T2DM among People with T2DM Presenting at the GWMH.

The study assessed the knowledge of participants on dietary recommendations for the management of T2DM. With regards to the total knowledge scores, the results show that 66% of study participants had good dietary knowledge. Details of participants' knowledge on dietary recommendations are presented in Table 4.6.

All study participants knew that fried foods are high in fat but only a half (51%) knew that not all fats and oils increase blood cholesterol levels. More than 80% of participants answered 'No' when asked the question 'Fruit juice can be drunk freely with little effect on BGL' but 11% had no knowledge on the effect of consumption of fruit juice on blood glucose. Although 97% of participants knew that Starchy foods raise blood glucose levels, about 60% of them believed that sugary foods require more insulin than starchy foods regardless of Carbohydrate content.

Table 4.5: Knowledge on dietary recommendations for T2DM among people with T2DM presenting at the GWMH

Variables	YES (%)	NO (%)	DON'T KNOW (%)
Restricting salt reduces blood pressure	123 (87.86%)	4 (2.86%)	13 (9.29%)
Sugary foods raise BGL	131 (93.57%)	4 (2.86%)	5 (3.57%)
Fried foods are high in fat	140 (100%)	0 (0.0)	0 (0.0)

Pastry/cakes are high in fat	107 (76.43%)	9 (6.43%)	24 (17.14%)
Diabetic products can be eaten freely without weight gain	12 (8.57%)	52 (37.14%)	76 (54.29%)
Starchy foods raise BGL	136 (97.14%)	0 (0.0)	4 (2.86%)
It is not possible to eat too much protein	34 (24.29%)	47 (33.57%)	59 (42.14%)
Any amount of fresh fruit can be eaten with little effect on BGL	26 (18.57%)	110 (78.57%)	4 (2.86%)
Fruit juice can be drunk freely with little effect on BGL	10 (7.14%)	114 (81.43%)	16 (11.43%)
Alcohol-free wines/lagers have no effect on BGL	22 (15.71%)	53 (37.86%)	65 (46.43%)
Cheese/biscuits are less fattening than cake	20 (14.29%)	23 (16.43%)	97 (69.29%)
Margarines/spreads have less energy than butter	51 (36.43%)	15 (10.71%)	74 (52.86%)
Protein raises BGL	58 (41.43%)	37 (26.43%)	45 (32.14%)
People with diabetes need to avoid foods containing any sugar	73 (52.14%)	63 (45.00%)	4 (2.86%)
All fats and oils increase cholesterol levels	72 (51.43%)	18 (12.86%)	50 (35.71%)
Full-fat foods affect BGL more than low-fat foods	121 (86.43%)	2 (1.43%)	17 (12.14%)
Sugary foods require more insulin than starchy foods regardless of CHO content	80 (57.14%)	2 (1.43%)	58 (41.43%)

4.6. Dietary Adherence among People with T2DM Presenting at the GWMH.

Frequency of intake of the food in the various food groups are shown in Table 4.6. None of the study participant reported consumption of sweets as dessert over the last month. Less than 50% of participants reported eating a portion of vegetables more than five times to everyday in a week with about 33% eating vegetables once a week or less often over the last month. However, with

fruit consumption, only 22% of participants reported to eating a portion of fruit more than five times to everyday in a week with about 50% of respondent consuming fruits less often in a month. Majority of study participants (76%) never consumed sugary drinks over the last month and 70% of participants never ate 'fast foods' like fried rice, pizza or burgers over the last month.

With regards to the total dietary adherence, the results show that 69% of study participants adhered to dietary recommendations.

Table 4.6: Food frequency and consumption behaviour among people with T2DM presenting at the GWMH

Foods	Frequency of consumption (%)			
	Never or very rarely	Once a week or less often	2- 4 times a week	5 - 6 times to everyday in a week
Eat a portion of vegetables	3 (2.14)	46 (32.86)	28 (20.00)	63 (45.00)

Eat a portion of fruit	20 (14.29)	69 (49.29)	20 (14.29)	31 (22.14)
Eat a cake, a sweet pastry	90 (64.29)	2 (1.43)	46 (32.86)	2 (1.43)
Sugary Drinks	106 (75.71)	18 (12.86)	14 (10.00)	2 (1.43)
Full-Fat Spread	92 (65.71)	3 (2.14)	43 (30.71)	2 (1.43)
Full Fat Milk	93 (66.43)	6 (4.29)	33 (23.57)	8 (5.71)
Skimmed Milk	115 (82.14)	8 (5.71)	15 (10.71)	2 (1.43)
Non-Dairy Milk	125 (89.29)	4 (2.86)	3 (2.14)	8 (5.71)
Processed Meat	84 (60.00)	28 (20.00)	26 (18.57)	2 (1.43)
Salty Foods	116 (87.86)	13 (9.29)	11 (7.86)	0 (0.00)
Salty Pastry	82 (58.57)	28 (20.00)	27 (19.29)	3 (2.14)
Fast Foods*	98 (70.00)	21 (15.00)	21 (15.00)	0 (0.00)
Dietary Behaviours				
Eat some sweets or a bar of chocolate	127 (91.43)	1 (0.71)	10 (7.14)	2 (1.43)
Eat sweets for dessert, apart from fruit	140 (100)	0 (0.00)	0 (0.00)	0 (0.00)
Eat Oily fish #	23 (16.43)	24 (17.14)	46 (32.86)	47 (33.57)
Have 3 or more regular meals in a day	39 (27.86)	24 (17.14)	15 (10.71)	62 (44.29)
Eat breakfast within about 2 hours of waking	41 (29.29)	22 (15.71)	17 (12.14)	60 (42.86)
'Snack' on high-fat/sugar foods between meals	91 (65.00)	24 (17.14)	12 (8.57)	13 (9.29)
Eat a portion of bread like 1 slice of bread	17 (12.14)	14 (10.00)	23 (16.43)	8 (61.43)
Choose higher fibre breads like wheat bread	64 (5.71)	29 (20.71)	7 (5.00)	40 (28.57)
Eat a bowl of breakfast cereal like porridge	35 (25.0)	18 (12.86)	16 (11.43)	71 (50.71)
Choose higher fibre cereals like oats	35 (25.00)	15 (10.71)	14 (10.00)	76 (54.29)

*Fast foods: fried rice, pizza or indomie # Oily fish: fresh or tinned salmon, sardine

4.7. Perceived Family Support among People with T2DM Presenting at the GWMH.

The study assessed participants perceived family support. In all, 57% of participants interviewed reported high perceived family support.

4.8. Factors Associated with Good Glycemic Control among People with T2DM Presenting at the GWMH

At the bivariate level, no significant association was observed between socio-demographic characteristics (age, sex, marital status, education, occupation and monthly income), alcohol consumption, medication adherence, physical activity and good glycemic control ($p>0.05$). Dietary adherence, referral to a dietician after being diagnosed with diabetes and perceived family support were found to be significantly associated with glycemic control ($p<0.05$).

respondents with good dietary adherence were 19.8 times likely to have good glycemic control as compared with respondents with poor dietary adherence (UOR=19.8, 95% CI: 7.67, 51.06, p<0.001) and the association was significant. Additionally, respondents referred to a dietician after being diagnosed with diabetes were 7.43 times more likely to have good glycemic control compared with those who were not referred (UOR=7.43, 95%CI: 3.32, 16.67; p<0.001). Respondents with high perceived family support were about six times more likely to have good glycemic control than respondents with low perceived family support (UOR=5.95, 95%CI: 2.83, 12.49; p<0.0001).

After controlling for the effect of socio-demographic characteristics (age, sex, marital status, education, occupation and monthly income), alcohol consumption, medication adherence, physical activity, referred to a dietician after diagnosis and family support in the adjusted model, dietary adherence was significantly associated with good glycemic control (p<0.0001). The odds of having good glycemic control was 12.3 times greater among respondents with good dietary adherence compared with those with poor dietary adherence (aOR=12.33, 95%CI: 3.64, 41.75; p<0.001).

After controlling for the effect of socio-demographic characteristics, alcohol consumption, medication adherence, physical activity and family support, a significant association was also observed between referral to a dietician and good glycemic control (p=0.007). Respondents, referred to a dietician after being diagnosed with diabetes were 4.2 times more likely to have good glycemic control compared with those who were not referred (aOR=4.20, 95%CI: 1.47, 12.01; p=0.007). Although high perceived family support was significantly associated with good glycemic control in the crude analysis, its significance disappeared after adjusting for the effect

of socio-demographic characteristics and other variables in the adjusted model (aOR=2.05, 95%CI: 0.72, 5.82; p=0.177). Results are shown in Table 4.8.

Table 4.8. Simple logistic regression model of Factors associated with good glycemic control among people with T2DM presenting at the GWMH

Variables	UOR	95% CI	p-value	aOR	95 % CI	p-value
Age	0.98	0.95, 1.02	0.409	1.01	0.95, 1.05	0.793

Sex (Ref= Male)						
Female	1.03	0.46, 2.31	0.935	0.81	0.24, 2.76	0.737
Marital Status (Ref= Not married)						
Married	0.73	0.37, 1.44	0.370	0.87	0.32, 2.42	0.802
Education (Ref= No formal education)						
Basic education	0.98	0.44, 2.18	0.965	0.72	0.22, 2.33	0.585
SHS & above	0.76	0.28, 2.04	0.598	0.67	0.14, 3.15	0.651
Occupation (Ref= Unemployed)						
Employed	0.85	0.38, 1.87	0.690	1.17	0.35, 3.86	0.788
Monthly Income (Ref= < GHC 200.00)						
GHC 200.00 to GHC 499.00	1.05	0.47, 2.31	0.908	1.65	0.50, 5.41	0.409
GHC 500.00 & above	0.41	0.13, 1.25	0.116	0.41	0.06, 2.54	0.337
Alcohol Consumption (Ref= Yes)						
No	1.36	0.57, 3.21	0.479	2.43	0.69, 8.56	0.166
Referred to a dietician (Ref= No)						
Yes	7.43	3.32, 16.67	**<0.0001**	4.20	1.47, 12.01	**0.007**
Medication Adherence (Ref= Low)						
Medium	0.91	0.26, 3.11	0.876	0.54	0.08, 3.50	0.522
High	0.76	0.23, 2.49	0.656	0.43	0.07, 2.50	0.350
Physical Activity (Ref= Low)						
High	1.75	0.38, 1.47	0.408	0.70	0.27, 1.81	0.464
Dietary adherence (Ref = Poor)						
Good	19.8	7.67, 51.06	**<0.0001**	12.33	3.64, 41.75	**<0.0001**
Perceived Family support (Ref=Low)						
High Support	5.95	2.83, 12.49	**<0.0001**	2.05	0.72, 5.82	0.177

CHAPTER 5

DISCUSSION

5.0. Introduction

The aim of the study was to assess dietary adherence and its association with glycemic control in adults with type 2 diabetes mellitus seeking treatment in Ga West Municipal Hospital. The

discussion is presented under the following headings: knowledge on dietary recommendations for T2DM, adherence to dietary recommendations, glycemic control, and association between dietary adherence and glycemic control.

5.1. Knowledge of Patients on Dietary Recommendations for T2DM

Dietary knowledge plays a crucial role in increasing awareness on good dietary practices and improves dietary behaviours among people with type 2 diabetes (Alliance, 2011).

In this study, more than 80% of the respondents knew that consuming fruit juice without restrictions had a huge effect on blood glucose level and majority of study respondents were aware that sugary and starchy foods raise blood glucose level. This shows that some fundamental dietary messages on the effect of total carbohydrate, and not merely sugar on blood glucose levels are reaching respondents

However, understanding appeared lower with regards to the caloric content of fats and oils and their effect on blood cholesterol level. Less than half of the respondents were aware that not all fats and oils adversely affected cholesterol level. This is consistent with the findings among adults with type 2 diabetes in Ireland where less than 50% of respondents knew that not all fats and oils increase blood cholesterol level (Breen et al, 2015). This clearly shows that some specific areas regarding fats and oils, its energy content and effect on blood cholesterol level require greater emphasis and reinforcement during T2DM dietary education.

This study found that majority of participants have good knowledge on dietary recommendation. This finding is, however, contrary to previous evidence gathered among type 2 diabetics in the Upper west region of Ghana (Issah, 2016). This difference in dietary knowledge may likely be explained by the relatively higher educational level of the participants in this study. It could also be due to the diabetes management education clients receive at the diabetic clinic or the availability of a dietician in the hospital.

Good dietary knowledge among respondents can help them make healthy food choices which would lead to optimal glycemic control and reduce the risk of complications associated with poor management of diabetes.

5.2. Adherence to Dietary Recommendations among T2MD Patients

Adherence to diet plan is a vital element to achieving glycemic control and prevention of macro and micro vascular damage among people with type 2 diabetes. To ensure effective management of type 2 diabetes, patients must completely modify their food and eating patterns (Hertz et al., 2005). Findings from this study show that, 69% of the respondents adhered to dietary recommendations. This is comparable with evidence from Nigeria among patients with type 2 diabetes (Emmanuel & Otovwe, 2015). Another study among adult South Asians with type 2 diabetes also reported 54% dietary adherence among study participants (Emadian, England &Thompson, 2017).

Contrary to the findings of this study, Worku, et al, (2015) reported that the general proportion of good dietary adherence among respondents with type 2 diabetes in Yekatit 12 Medical College Hospital in Ethiopia was less than half (48.6%). High level of good dietary adherence in this study could be related to high referrals (69%) to the dietician who is able to help the participants plan their diet and provide supportive supervision to ensure high adherence. It is also important to note that the high proportions of good dietary knowledge and high perceived family support among study respondents may have contributed to the high proportions of good dietary adherence reported.

5.3. Glycemic Control among T2DM Patients

In this study, the proportion with good glycemic control was 60%. This concurs with the study by Titty (2010) at the Tamale Teaching hospital, which reported 60 % good glycemic control among respondents. Another study by Longo-Mbenza et al. (2008) in Kinshasa also reported a

68% prevalence of good glycemic control among respondents. High proportion of glycemic control in this study may be due to the consistent clinic day counselling and the fact that most participants (55%) adhered to their medication which is crucial in maintaining glycemic control.

Modification of lifestyle and improvement in diabetes self-care behaviour including utilization of dietetic services, exercise, medication, cessation of alcohol consumption and smoking improves glycemic outcomes among people living with type 2 diabetes (Peyrot et al, 2005; Evert et al, 2014; Nyenwe et al, 2011). Findings from this study showed improved lifestyle and behaviour towards the management of diabetes among participants. None of the respondents smoked tobacco and 81% do not drink alcohol at all. This finding is consistent with the findings of Nawfal et al. (2017) on the predictive factors associated diabetes among adults in Ghana. They reported that high proportions (76%) of respondents had never used tobacco and 58.7% had never taken alcohol. This study also identified high utilization of dietetic services among study participants. The results showed that 69% of respondents were referred to a dietician. This finding is inconsistent with findings from a study among Lebanese patients with type 2 diabetes where only 34% of respondents were referred to a dietician (Alameddine et al, 2013).

Referral to a dietician after diagnosis was found to be significantly associated with good glycemic control. Similar to the findings of this study, a study in Dunedin, New Zealand reported that referral to a registered dietitian is associated with reduced glycemia among patients with type 2 diabetes (Coppell et al, 2010). High utilization of dietetic services in this study could be as result of the referrals from physicians. Referral by a medical doctor is a significant factor that influences the utilization of dietetic services by people with type 2 diabetes (Alameddine et al, 2013). Studies have also shown that actions taken by dieticians to improve service delivery have only been successful through strong collaborations with doctors who complied with the referral

system. When there is low doctors' commitment to referral systems, utilization of dietetic services is often minimal (Peyrot & Rubin, 2008; Senior, MacNair & Jindal, 2008).

In this study, a high proportion of participants were adherent to their medication although this was not significantly associated with good glycemic control. This finding is consistent with findings from a study among Ghanaians adults with type 2 diabetes in Kwahu South District (Tengey, 2012). It is possible that referral to the dietician may have had positive impact on adherence to medication due to counselling received on the importance of adhering to both diet and medication to achieve optimal glycemic control.

Most participants (51%) in this study were physically inactive. This finding is inconsistent with evidence among type 2 diabetes patients in Ethiopia where more than half (53%) of respondents were found to be physically active (Berhe & Kahsay, 2013). Several reasons may have prevented high physical activity including insufficient access to favourable environment and facilities to perform exercise; as well as fear of increasing blood pressure especially among diabetics with comorbidities like hypertension (Booth et al, 2013).

5.4. Association between Dietary Adherence and Glycemic Control

Adherence to dietary or nutrition therapy leads to a sustained reduction in glycemic level in people with type 2 diabetes mellitus (Funnell et al, 2011). According to the Institute of Medicine [IOM] (2000) diet therapy has been recognised to improve health outcomes among diabetics and reduces the cost associated with its management. This study found a strong association between dietary adherence and good glycemic control (AOR=12.33, 95%CI: 3.64, 41.75; $p<0.0001$). This supports the findings of Biru (2017) among type 2 diabetes patients in Ethiopia where adherence to dietary recommendations was significantly associated with good glycemic control. Similar findings among Chinese type 2 diabetics has revealed adherence to diet plans as the best strategy to achieve optimal glycemic control (Jiang, 2012). Another study among type 2 diabetics in

South West Ethiopia also reported that adherence to dietary regimen was associated with a reduced odds of poor glycemic control (AOR=0.35, P=0.005). Although dietary adherence was significantly associated with glycemic control, the association must be interpreted with caution due to the wide confidence intervals most likely resulting from the small sample size.

Among people with type 2 diabetes, family support is associated with improved self-care behaviours, preventions of complications, and improved health (DiMatteo, 2004; Gallant, 2003; Lett et al, 2005; Luttik et al, 2005). There is an evidence that family support is essential for successful management of diabetes mellitus (Gallant, 2003).

Perceived family support in this study was found to be significantly associated with good glycemic control at the bivariate level only. This concurs with a study by Osuji et al. (2018) among type 2 diabetes patients in Southwest Nigeria where perceived family support was found to be significantly associated with glycemic control (Osuji et al, 2018). They reported that participants with high perceived family support were 112 times more likely to have good glycemic control compared to those with low perceived family support (UOR = 112.51, 95% CI = 46.64, 271.44; p<0.00001).

In adjusted models, the association between perceived family support was nonsignificant. This suggests that family support may have influenced glycemic control through other means and not necessarily through dietary adherence. Family support could have made its impact on glycemic control through general improvement in quality of life, facilitation of patient access to healthcare as well as dietary information and medications.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This study highlighted several issues regarding the association between dietary adherence and glycemic control among adults with type 2 diabetes seeking health care at the Ga West

Municipal Hospital. The findings from the study showed that 60% of study participants had good glycemic control. Generally, knowledge on dietary recommendations among respondents was good and lifestyle factors (Medication adherence, physical activity and alcohol consumption) were found not to be significantly associated with glycemic control. Dietary adherence and referral to a dietician were found to be significant predictors of good glycemic control among study respondents.

Findings from this study go a long way to support findings from several research suggesting that diet is an integral component in the management of type 2 diabetes and significantly contributes to the achievement of optimal glycemic control among individual with type 2 diabetes.

6.2. Recommendation

Nutrition/diet education provided to patients with diabetes on the clinic days should be intensified and targeted at all patients receiving care.

Dietary adherence among T2DM patients should be assessed routinely so that adherence can be improved for all, and non- adherent patients can be identified as patients at risk for poor glycemic control. In this way, they can be targeted for specialised nutrition interventions as well as medical interventions.

The management of the Ga West municipal hospital should improve collaborations between dietician and physicians by ensuring that physicians fully comply with referral protocols in the treatment and management of T2DM.

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APPENDICES

Appendix 1: Participant's Information Sheet and Consent Form

Tittle of study: Dietary Adherence and Glycaemic Control among Type 2 Diabetes Patients in Ga West Municipal Hospital

Introduction: I am Gloria Ama Ansah from the School of Public Health and I am conducting a research on Dietary Adherence and Glycaemic Control among Type 2 Diabetes Patients in Ga West Municipal Hospital a part of my school work. I would like to invite you to be part of my research.

Background and Purpose of Research

Diabetes is a global issue and is one of the largest global health emergencies of the 21st century. Ghana, West Africa, has been considerably affected by the dual burden of infectious disease and NCDs, including high prevalence of diabetes. The burden of diabetes has been increasing rapidly due to high incidence which may be attributed to unhealthy diets. Poor glycaemic control can lead to various macro and micro-vascular complications. I am undertaking a study on dietary adherence and glycaemic control among type 2 diabetes mellitus patient attending diabetic clinic at the Ga West Municipal Hospital. The purpose of the research is to assess the knowledge of patients on dietary recommendations for T2DM, adherence to dietary recommendations among T2MD patients and examine how perceived family support influences the association between dietary adherence and glycemic control.

Nature of Research

This is a cross-sectional research that hopes to assess dietary adherence and glycaemic control among type 2 diabetic mellitus patients attending diabetic clinic at the Ga West Municipal Hospital. It is a quantitative study that uses a structured questionnaire to solicit information from the respondents. A total of 150 respondents will be interviewed for the study and will require about 15 minutes of the respondent's time to complete a questionnaire.

Duration

I will require 15 minutes of your time.

Potential Risks

I do not anticipate any potential risks of participation to you. Most of the interview questions are not particularly sensitive. Nevertheless, if for some of the questions you feel reluctant to discuss them, you can choose not to answer or discuss any question, and you can choose to drop out at any time, even in the middle of the interview. You do not have to give me any reason for not responding to any question, or for refusing to take part in the research.

Cost

There will be no costs for participating in the study.

Benefits

There will be no direct benefit to you, but your participation is likely to help me find out more about factors influencing dietary adherence and its associated glycemic level among diabetics in the GA west district. It is hoped that results obtained for this study will be used by policy makers and the community in particular to either improve upon existing measures of managing type 2 diabetes patients or to enforce existing ones with the objective of better improving diabetic control for patients.

Privacy/Confidentiality

Questionnaires will be administered to you outside the diabetic clinic to ensure privacy. All information gathered from the research will remain confidential. Your identity as a participant will not be disclosed to any unauthorized persons. Any information about you will be coded and I will be password protected. Nothing that you tell me today will be shared with anybody outside the research team, and nothing will be attributed to you by name. Any references to your identity that would compromise your anonymity will be removed or disguised prior to the preparation of the reports and publications.

Voluntary Withdrawal

You do not have to take part in this research if you do not wish to do so, and choosing to participate will not affect you in any way. You may stop participating in the research at any time that you wish without you being affected. I will give you an opportunity at the end of the interview to review your remarks, and you can ask to modify or remove portions of those, if you do not agree with my notes or if I did not understand you correctly.

Compensation

You will not be provided any incentive to take part in the research.

Outcome and Feedback

Outcome of the research and appropriate recommendations will be available on the University of Ghana website which will be accessible to the general public.

Funding Information

The research is fully funded by the principal investigator.

Sharing of Participants Information/Data

The information generated from the research will be owned by the principal investigator and the Department of Population, Family and Reproductive Health, School of Public Health, University of Ghana.

Provision of information and Consent for Participants

A copy of the information sheet will be given to you after it has been signed or thumb-printed to take home.

In case you have any questions on the research later, please do not hesitate to contact **Gloria Ama Ansah**, Department of Population, Family and Reproductive Health, School of Public Health, University of Ghana. (Tel: 0242065871) Email: ansahama2@gmail.com.

Also, if you need further clarifications on ethical issues and your rights as a participant, please kindly contact the Administrator for the Ghana Health Service Ethics Review Committee-Research and Development Division, Ghana Health Service Accra (Ms Hannah Frimpong on: 0507041223).

CONSENT FORM

STUDY TITLE: Dietary Adherence and Glycaemic Control among T2DM Patients in Ga West Municipal Hospital

PARTICIPANTS' STATEMENT

I acknowledge that I have read or have had the purpose and contents of the participants' information sheet read and all questions have been satisfactorily explained to me in a language I understand (English ☐ /Ga☐ /Twi☐) . I fully understand the contents and any potential implications as well as my right to change my mind even after I have signed this form.

I voluntarily agree to be part of this study

Name or initials of participant …….. ID Code ……..

Participants' Signature……..OR Thumb Print……..

Date……

INTERPRETERS' STATEMENT

I interpreted the purpose and contents of the participants' information sheet to the afore named participant to the best of my ability in the (Ga /Tw☐) lan☐age to his/her proper understanding.

☐

All questions, appropriate clarifications sort by the participant and answers were also duly interpreted to his/her satisfaction

Name Interpreter ……

Signature Interpreter ……..…….. Date……

Contact details:

STATEMENT OF WITNESS

I declare that I was present when the purpose and contents of the participants' information sheet was read and explained thoroughly to the participant in the language he/she understood (English /Ga /T☐i ☐ ☐

I confirm that he/she was given the opportunity to ask clarifications and same were duly answered to his/her satisfaction before voluntarily agreeing to be part of the research.

Name …….

Signature……OR Thumb Print……

Date …….

INVESTIGATOR STATEMENT AND SIGNATURE

I certify that the participant has been given ample time to read and learn about the study. All questions and clarifications raised by the participant has been addressed.

Researcher's Name……

Signature……

Date……..

Appendix 2: Study Questionnaire

SECTION A: Socio-Demographic Characteristics and Basic Disease Info

1.0 Participant ID: ☐

0.1. Date: / /

2.0. Age (Years): ☐

3.0 Sex: M ☐ F ☐

4. Religion	1. Christianity ☐ 2. Islam ☐	3. Others ……..……..
5. Marital Status	1. Married ☐ 2. Single ☐	3. Separated ☐ 4. Widow/widower ☐
6. What is your Level of education?	1. No formal education ☐ 2. Elementary ☐ 3. JHS ☐	4. SHS/Secondary/Vocational/ Technical ☐ 5. Tertiary education ☐
7. What is your occupation group?	1. Managers ☐ 2. Professionals/skilled ☐ 3. Retired ☐	4. Skilled Agricultural workers ☐ 5. Service and Sales ☐ 6. Unemployed ☐
8. What is your estimated monthly level of income?	1. Gh¢199.00 or less ☐ 2. Gh¢200.00 - Gh¢499.00 ☐ 3. Gh¢500.00 - Gh¢999.00 ☐	4. Gh¢1,000.00 - Gh¢1,999.00 ☐ 5. Gh¢2,000.00 - Gh¢3,999.00 ☐ 6. Gh¢4,000.00 & Above ☐
9. How long have you been of diabetes treatment?	1. Less than a year ☐ 2. Two to five years ☐	3. Five to nine years ☐ 4. Ten to 19years ☐ 5. 20 years and more ☐
11. Which of these complications or conditions do you have? **(Tick as many that apply)**	1. Hypertension (High BP) ☐ 2. Retinopathy (Eye disease) ☐ 3. Neuropathy (Nerve disease) ☐ 4. Cardiovascular disease ☐	5. Chronic Kidney Disease ☐ 6. Diabetic Sores ☐ 7. Hypoactive sexual arousal ☐ 8. Other (s):…… ☐ 9. No complication
14. What is participant's HbA1c results?	*1. Within last 3months?* *……..% or……..mmol/mol*	*2. Within 1st year of treatment or diagnosis? .....% or .....mmol/mol*
15. What is participants blood sugar level (FBS)?	*1. current* ☐ *2. two months ago* ☐	*3. Three months ago* ☐

SECTION B: Lifestyle Factors		
1. Do you Smoke?	1. Yes ☐	2. No ☐
2. How often do you take in alcohol?	1. Every Day ☐ 2. < 3 times a week ☐	3. Few times in a month/year ☐ 4. Not at all ☐
3. Since you were diagnosed with diabetes have you ever been referred to a dietician? ***Skip Q5-6 if not referred***	1. Yes ☐	2. No ☐
5. Do you sometimes miss your appointment with the dietician?	1. Yes ☐	2. No
6. When was your last visit to the dietician?	1. more than six months ☐ 2. two months ago ☐	3. one month ago ☐ 4. more than three month ☐

SECTION C: Patient's Knowledge on Dietary Recommendations				
	Questions	**Yes**	**No**	**Don't Know**
1.	Restricting salt reduces blood pressure			
2.	Sugary foods raise BGL			
3.	Fried foods are high in fat			
4.	Pastry/cakes are high in fat			
5.	Diabetic products can be eaten freely without weight gain			
6.	Starchy foods raise BGL			
7.	It is not possible to eat too much protein			
8.	Any amount of fresh fruit can be eaten with little effect on BGL			
9.	Fruit juice can be drunk freely with little effect on BGL			
10.	Alcohol-free wines/lagers have no effect on BGL			
11.	Cheese/biscuits are less fattening than cake			
12.	Margarines/spreads have less energy than butter			
13.	Protein raises BGL			
14.	People with diabetes need to avoid foods containing any sugar			
15.	All fats and oils increase cholesterol levels			
16.	Full-fat foods affect BGL more than low-fat foods			
17.	Sugary foods require more insulin than starchy foods regardless of CHO content			

SECTION D: Medication-Taking Adherence (MMAS-4)		
1. Do you ever forget to take your medicine?	1. Yes ☐	2. No ☐
2. Are you careless at times about taking your medicine?	1. Yes ☐	2. No ☐
3. Sometimes if you feel worse when you take the medicine (or travel), do you stop taking it?	1. Yes ☐	2. No ☐
4. When you feel better do you sometimes stop taking your medicine?	1. Yes ☐	2. No ☐

SECTION E: Perceived Family Support

We want to know how often family members do each of the following things. Just put down what usually happens at home—there are no right or wrong answers. Circle one number from the scale below that best shows how often the person being rated does each of the following things.

	Questions	**Strongly Disagree**	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**
1.	Follow my meal plan.					
2.	Take my medicine.					
3.	Take care of my feet.					
4.	Get enough physical activity.					
5.	Test my sugar.					
6.	Handle my feelings about diabetes.					
7.	Accept me and my diabetes.					
8.	Feel uncomfortable about me because of my diabetes.					
9.	Encourage or reassure me about my diabetes.					
10.	discourage or upset me about my diabetes.					
11.	Listen to me when I want to talk about my diabetes.					
12.	Nag me about diabetes.					

SECTION F: Assessment of Physical Activity

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

QUESTION	RESPONSE
1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?	_____ **days per week** ☐ No vigorous physical activities ***Skip to question 3***
2. How much time did you usually spend doing **vigorous** physical activities on one of those days?	_____ **Hours per day** _____ **Minutes per day** ☐ Don't know/Not sure
Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.	
3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.	_____ **Days per week** ☐ No moderate physical activities ***Skip to question 5***
4. How much time did you usually spend doing **moderate** physical activities on one of those days?	_____ **Hours per day** ____ **Minutes per day** ☐ Don't know/Not sure
Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.	
5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?	____ **Days per week** ☐ No walking ***Skip to question 7***
6. How much time did you usually spend **walking** on one of those days?	_____ **Hours per day** _____ **Minutes per day** ☐ Don't know/Not sure
The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.	
7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?	_____ **Hours per day** _____ **Minutes per day** ☐ Don't know/Not sure

SECTION G: Dietary Adherence: Food Frequency Questionnaire

How often do you eat the following foods?

	Questions Section A	Never or very rarely	Once a week or less often	2- 4 times a week	5 - 6 times to everyday in a week	Score
1.	How often did you eat a portion of vegetables? Include fresh, tinned and frozen vegetables.					
2.	How often did you eat a portion of fruit? Include fresh, frozen, tinned and dried fruit. Do not count fruit juices.					
3.	How often did you eat a cake, a sweet pastry like a donut or a sweet biscuit?					
4.	How often did you eat some sweets or a bar of chocolate?					
5.	How often did you drink sugary drinks? Include non-diet fizzy drinks, squashes, mixers, energy drinks, fruit juices or coffee, tea or other hot drinks with sugar or flavoured syrups.					
6.	How often did you use full-fat spread (butter or a full fat margarine) on your bread, potatoes or vegetables?					
7.	How often did you take Full fat milk					
8.	How often did you take skimmed milk					
9.	How often did you take non-dairy milk					
10.	How often did you eat processed meat? Include processed meat in sandwiches, ready meals and if eaten as a snack. Processed meat includes foods like corned beef or sausages					
11.	How often did you eat salty foods like popcorn, sprinkles, corn chips, corn puffs and salted nuts?					
12.	How often did you eat a salty pastry? Think about food like pies, pasties, donuts, sausage rolls or spring rolls.					
13.	How often did you eat 'fast foods' from a take-away or in a restaurant? Think about foods like burgers, fish and chips, fried chicken, kebabs, pizza, fried rice or curries with cream.					
14.	How often did you eat sweet like chocolate or dessert, apart from fruit, with your meals?					

15.	How often did you eat oily fish? Think about fresh or tinned salmon, trout, sardine, mackerel, herring or fresh tuna.					
	Questions Section A	**Never or very rarely**	**Once a week or less often**	**2- 4 times a week**	**5 - 6 times to everyday in a week**	**Score**
16.	How often did you have 3 or more regular meals in a day? Include light meals like a sandwich or a soup and roll. Don't include snack times when you ate only a biscuit a piece of fruit or vegetable sticks					
17.	How often did you eat breakfast (more than just a drink or one or two sweet biscuits) within about 2 hours of waking?					
18.	How often did you 'snack' or 'pick' on high-fat or high-sugar foods between meals? Think about food like biscuits, chocolate, cakes, crisps, nuts and cheese.					
19.	How often did you eat a portion of bread? Include bread in sandwiches and wraps. A portion of bread is 1 slice of bread					
20.	If you ate bread how often did you choose higher fibre breads like wheat bread					
21.	How often did you eat a bowl of breakfast cereal, porridge?					
22.	If you ate breakfast cereal how often did you choose higher fibre cereals like oats, corn or millet porridge?					