

**UNIVERSITY OF GHANA, LEGON
COLLEGE OF HEALTH SCIENCES
SCHOOL OF PUBLIC HEALTH**



**ADHERENCE TO DIET AND EXERCISE REGIMEN AMONG PATIENTS WITH
TYPE 2 DIABETES MELLITUS AT THE TEMA GENERAL HOSPITAL, GREATER
ACCRA, GHANA.**

BY

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DECLARATION

I hereby do declare that except for references to other people's work which have been duly acknowledged, this piece of work is my own composition and neither in whole nor in part has this work been presented for the award of a degree in this university or elsewhere.

SIGNATURE..... DATE.....

(GRACE DZIFA WORNYOH)

SIGNATURE..... DATE.....

(DR. BENEDICT WEOBONG)

DEDICATION

I dedicate this dissertation to my parents, Mr. and Mrs. Wornyoh. To my siblings: Isaac Brown, Enoch, Jonathan, Richard, Joseph and Benjamin, I say thank you. Your support and love was in the end what made this research possible.

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ABSTRACT

Background: Diabetes is not curable. Lifestyle changes such as diet and physical exercise are important factors in achieving good control of type-2 diabetes (T2D) thereby avoiding its long-term complications. However, knowledge on the factors that hinder the adherence to diet and physical exercise in diabetes management is limited. This study aimed to determine the adherence to dietary and exercise requirements among type 2 diabetics in the Tema General Hospital

Method: A cross-sectional design was used in the study. Consecutive sampling was used to sample 275 patients who met criteria. A closed ended questionnaire was used to collect the data. Chi-square was used to assess relationships between variables. Simple logistic regression was used to test the study's hypothesis. Results were reported as odds ratios with 95% confidence intervals.

Results: Adherence to dietary recommendations was 26.7%. Low socio-economic status of participants did not influence adherence to dietary and physical exercise recommendations. Participants on insulin only, (AOR=44.0; 95% CI=1.65- 1171; p=0.024). and those who were on drug and diet therapy, (AOR=55.3; 95%CI=5.59 – 547.6; p=0.001) were adherent to dietary recommendations. Participants who were not on herb therapy were less likely to be adherent to dietary recommendations (AOR= 0.002; 95%CI=0.001- 0.05; p<0.001). 67.8% of respondents were knowledgeable on the benefits of physical education and diet recommendations for diabetes management. Adherence to physical exercise recommendations was found to be 22%. Senior secondary school trained participants are less likely to adhere to exercise recommendations (AOR=0.01; 95%CI=0.001– 0.14; p= 0.004). Vocationally trained participants were less likely to be adherent to dietary recommendations (AOR=0.06; 95%CI=0.001-0.36; p<0.001). Participants who were knowledgeable about their

condition were likely to be adherent (AOR=38.8; 95%CI=3.01- 49.25; p=0.016). 96% of participants had the recommended 3 square meals a day.

Conclusion: Adherence to diet and exercise was found to be relatively low. The type of treatment and being on herb therapy was found to influence adherence to dietary recommendations. Majority of participants were knowledgeable about their condition.

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LIST OF ABBREVIATIONS

ADA.....	American Diabetes Association
DM.....	Diabetes Mellitus
GHS.....	Ghana Health Service
IDF.....	International Diabetes Federation
HBAIC...	Glycated Hemoglobin
SES.....	Socio-Economic Status
T2D.....	Type 2 Diabetes
TGH.....	Tema General Hospital
WHO....	World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Diabetes mellitus (DM) is one of the most common chronic diseases in both Western and developing countries. (King, Aubert & Herman, 1998; King & Rewers, 1993). Diabetes Mellitus has become a global health issue facing the world in this new millennium with its management and premature mortality affecting the total health care expenditure in several countries, especially in less developed and poor ones (Hu, 2011). The International Diabetes Federation (IDF) estimates that, 425 million individuals were living with diabetes worldwide in 2017 (IDF Atlas, 2017). This number is projected to be 438 million by the year 2030 (Wild, et al, 2004). The prevalence of diabetes ranges from 4.3% in Sub-Saharan Africa to 10.9% in the Middle East and North Africa (IDF, 2013). It is however projected that the number of individuals with diabetes in Sub-Saharan Africa will be more than double the 2017 estimates of 16 million by 2045 (IDF Atlas, 2017).

This metabolic disorder is characterized by hyperglycemia and disturbances of carbohydrate, protein and fat metabolism secondary to an absolute or relative lack of the hormone insulin. Pre-diabetes mellitus is characterized by elevated blood glucose levels with fasting plasma glucose between 100 and 125 mg/dL or an oral glucose tolerance test between 140 and 200 mg/dL. Glucose levels greater than these values characterize DM (King, Aubert & Herman, 1998).

This rapid increase in the number of individuals with diabetes will mainly be due to rapid nutritional and epidemiological transitions in rural and urban communities (Kandala & Stranges, 2014). Prolonged period of diabetes increases the risk for other complications. Diabetes Mellitus (DM) is the leading cause of end-stage renal disease (ESRD), traumatic

lower extremity amputations, and adult blindness. It also predisposes patients to various cardiovascular diseases (Abejew, Belay, & Kerie, 2015). The frequency of diabetes is increasing many folds especially in South Asian population due to high genetic and non-genetic risk factors (Cheekurthy, et al., 2015). Diabetes has significant effect on adult population (Geiss, et al. 2000; Lee et al. 1995). The risk for death is twice in people with diabetes when compared to those without diabetes (CDC, 2011).

Diabetes imposes a significant burden on health services and has become a global public health problem (Amod, Ascott-Evans & Berg, 2012; Zimmet, 2012). Although diabetes was considered a disease of the wealthy class, current shift in rural and semi-urban lifestyles shows populations from low socio-economic communities are affected (Inzucchi, Bergenstal & Buse, 2012).

The occurrence of diabetes in individuals is associated with several factors including societal and biological factors (Gatimu, Milimo & Sebastian, 2016). Studies have shown an association between diabetes and socio-economic factors such as education, employment status, wealth and social class (Assari, Lankarani & Lankarani, 2014; Abubakari & Bhopal, 2008). Behavioural characteristics of the population such as physical inactivity, poor dietary intake, inadequate intake of fruits and vegetables, tobacco use and alcohol consumption are all factors associated with diabetes particularly type 2 diabetes mellitus (Motala, Esterhuizen, Gouws, Pirie & Omar, 2008).

In Ghana, studies in the general population have estimated that, 3.3% to 6% of the population has diabetes with the prevalence increasing with age. Prevalence is also higher in urban than in rural areas (Saeed, Abdul-Aziz, Nguah & Zhao, 2013).

Medication is not the sole method of treating type 2 diabetes mellitus; significant changes to the patient's lifestyle with respect to dietary habits and regular physical activity are also

required (Franz, MacLeod, Evert, 2017). In fact, lifestyle change is the most challenging and difficult part of the treatment. Many patients tend to follow medical and dietary recommendations selectively (Ahola AJ, Groop, 2013).

Non-adherence to treatment of diabetes mellitus is an issue known both in the national and international scene as it affects the physiological response to disease, doctor-patient relationship and increases direct and indirect costs of treatment (Parchman, Zeber & Palmer, 2010; Zhang, Zhang, Brown, Vistisen, Sicree & Shaw, 2010). Most studies focus on medication adherence and factors associated with it (Bubalo, Clark, Jiing, Johnson, Miller & Clemens, 2010). On the other hand, there is a need for studies that investigate dietary parameters and physical exercise. This study aimed to investigate the adherence to dietary and physical exercise treatment of type 2 diabetes mellitus and variables of metabolic control, clinic and socio-demographic.

1.2 Problem Statement

Life-style changes such as balanced diet and physical exercise are important factors in achieving good control of type-2 diabetes (T2D) thereby avoiding its long-term complications (Shrivastava, Shrivastava & Ramasamy, 2013). Adherence is defined as the degree to which a person's behavior that is, taking medication, following a diet and or performing lifestyle changes correspond with agreed recommendations from a qualified health care provider (WHO, 2015).

Dietary adherence and management by diabetes patients is one of the vital treatment components to be followed over the long term and it has been found to lower glycated hemoglobin (A1C) levels by 1% to 2% (4–6), this helps to prevent or delay micro-and macro vascular morbidities among patients (Raj et al., 2018). Again, healthy dietary habits such as minimizing the consumption of high glycemic foods, fats and carbohydrates is known to

contribute in decreasing the level of blood glucose, which will lead to reducing the amount of needed insulin in the body (Hamdy, Laurie & Edward, 2001). Physical exercises especially among diabetes patients is recommended because it reduces blood glucose levels, thereby reducing the amount of insulin needed and increasing insulin sensitivity (Colberg, Sigal & Fernhall, 2010). Physical activity enhances glycemic control and insulin action, reduces cardiovascular risk and helps weight loss, which improves diabetes mellitus patients' general well-being. ADA recommends adults with diabetes to perform at least 150 minutes per week of moderate to intense aerobic physical activity (improves 50%–70% of maximum heart rate). It is to be spread over at least 3 days/week with no more than two consecutive days without exercise along with weight training exercises (ADA, 2013).

Notwithstanding the development of full guidelines for realizing finest diabetes management, studies suggest that translation of dietary guidelines into daily routine of patients is a challenge for the majority of patients with diabetes (Monnier, Grimaldi, Charbonnel, et al. 2004). Additionally, it is noticed that most diabetics fail to include exercise in their daily schedules. It is further known that even in those who exercise the intensity of physical activity is low (Thomas, Alder & Leese, 2004).

There is very limited knowledge on factors that facilitate or hinder the practice of physical activity in diabetics. It is therefore feared that the burden of this disease may be increasing gradually. Nonetheless, there is rarity of empirical studies on adherence to lifestyle recommendations and patients' awareness in Ghana. In addition to that, T2D is preventable and rather affecting people in their later age. This is a major public health problem and could make people suffer premature death (Butt et al 2015). Therefore, this study is designed to investigate diet and exercise adherence and to determine the association between adherence to diet and physical exercises among T2D patients with demographic and clinical factors. It

also aims to evaluate the knowledge level of the importance of diet and physical exercise on managing diabetes.

1.3 Significance of the study

The prevalence of diabetes is increasing globally without equivalent increase in research and other resources to fight the disease. In Ghana, the increase is more rapid due to the changes in lifestyle and aging of the population. Healthy lifestyle practices such as adherence to diet and exercise protocols are known to help reverse this trend of burden. The nature of these lifestyle factors in Ghana and particularly Tema Metropolis is unknown. The Tema hospital has over the years reported increasing trend in this disease and the poor attitude of patients regarding treatment other than medication. It is hoped that the study will address this issue by establishing the reasons and factors associated with patients' adherence to diet and exercise recommendations. Knowing/profiling these lifestyle factors/practices with respect to adherence will form the basis for the design of culturally appropriate/personalized interventions.

Again, a study on the adherence, reasons and lifestyle modification factors in diabetes management are essential for the formulation and implementation of appropriate measures to enhance care and support for patients with diabetes.

1.4 Conceptual framework

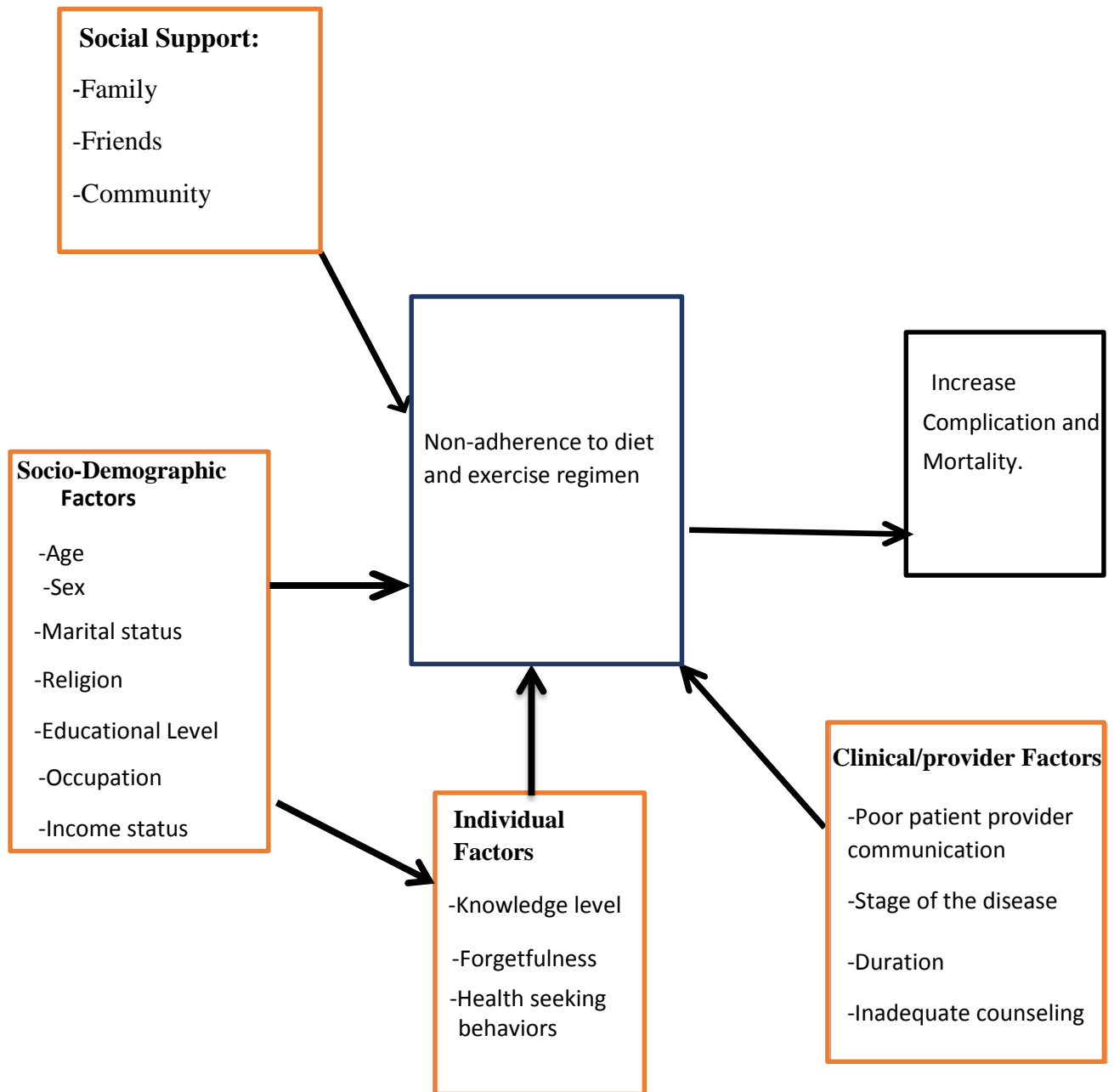


Figure 1: Conceptual Framework of factors influencing non-adherence of dietary and exercise regimen

Source: Author's Construct

1.5 Narrative

The framework attempts to explain the various factors influencing non-adherence to diet and exercise. These factors could be categorized into four main groups; social support, socio-demographic characteristics, individual factors and clinical or provider factors.

To begin with, it can be argued that adherence to diet and exercise can be achieved when there is adequate counseling, good doctor-patient communication. In the case where there is inadequate counseling or poor doctor-patient communication, it can affect non-adherence to dietary and exercise recommendation hence increasing complications and resulting in mortality. However, constant development of confidentiality and trusting relationships with the patient may improve adherence remarkably (Kalyango et al., 2008).

Furthermore, individual factors such as knowledge level, forgetfulness and health seeking behaviors can influence non-adherence to diet and exercise. It is very important, when individuals are aware or have knowledge on the need to exercise and diet (Freeman et al., 2012). Based on this, the patient will make a decision on whether to adhere or not. Also, health seeking behaviors are very crucial in assessing the effects of chronic diseases over time (Thapa, 2018). People with appropriate health-seeking behaviors are ready to recognize disease symptoms, particularly non-communicable chronic diseases, as quickly as possible to seek medical care, which is more likely to decrease disease complications and potential co-morbidities (Hjelm & Atwine, 2011).

Worldwide, socio-demographic characteristics have been recognized to have an influence on non-adherence to diet and exercise. The model demonstrates how educational level of an individual could influence one's adherence to diet and exercise. It could be argued that individuals who are educated would have knowledge on the importance to adhere to diet and exercise to improve upon the condition as compared to those who are not educated or with low level of education. Nevertheless, Divya & Nadig (2015) in their research found that the

risk of non-adherence is very high when patients cannot read and understand basic written provider's instructions. It could also as well be argued that those who are married are likely to adhere to exercise and diet compared to unmarried ones. According to Freeman et al., (2012), a higher proportion of non-adherence is among married women as compared to single (unmarried) women. More so, income status could affect one's non-adherence to diet and exercise. When one has a high income status it is possible that one could access health. Religion could also affect one's health seeking behavior and in turn have an impact on the individual's adherence to diet and exercise.

Lastly, non-availability of social support can also influence non-adherence. When patient have friends and families who fail to support in diverse ways, it can cause patients to fail to adhere to dietary and exercise regimen.

1.6 Research Questions

Based on the established need for this study, the following research questions were addressed.

1. What is the level of non-adherence to diet and physical exercise among T2D patients and associated clinical and socio-demographic predictors of non-adherence to physical exercise among type 2 diabetes patients?
2. What is the level of knowledge and associated factors on the role of dietary and exercise requirements in the management of T2D?
3. What is the eating habit and patterns of T2D patients?

1.7 Aim

To determine the level of adherence among patients regarding dietary and exercise requirements in the Tema General Hospital in the Greater Accra Region of Ghana.

1.7.1 Specific objectives

1. To estimate the level of adherence to diet and adherence to physical exercise recommendations among type 2 diabetes patients.
2. To estimate the association between knowledge, socio-demographic, clinical factors and the role of dietary and exercise requirements in the management of T2D.
3. To assess the eating habit and patterns of T2D patients

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter overviews various relevant literature on diabetes; its global, national and local prevalence as well as treatment methods. The literature review mainly focuses on areas captured by the research objectives. Again, areas such as etiology, types and risk factors are covered.

2.1 Diabetes

Diabetes Mellitus is a complex, chronic disease and condition characterized by elevation of the level of glucose in the blood. Insulin, a hormone produced by the pancreas, controls the blood glucose level by regulating its production and storage. The condition may lead to decrease of the body's ability to respond to insulin or a decrease in the insulin produced by the pancreas which leads to abnormalities in the metabolism of carbohydrates, proteins and fats. The result may be hyperglycemia which may lead to acute metabolic complications including ketoacidosis and in the long term contribute to chronic microvascular complications (Smeltzer & Bare 1992).

Diabetes can be classified as Type 1, Type 2 diabetes, and Gestational Diabetes Mellitus (GDM), where type 1 diabetes occurs due to beta-cell destruction, usually leading to absolute insulin deficiency. The pancreas produces insufficient amounts of the insulin therefore requiring insulin injections to control blood glucose. In Type 2 diabetes, due to a progressive defect in insulin secretion or decrease in sensitivity of the cells to insulin, it leads to insulin resistance. Lastly, GDM is diabetes diagnosed in the second or third trimester of pregnancy as a result of inhibition of insulin action by activity of hormones produced by the placenta. It occurs in about 2-5% of all pregnancies. About 30-40% of patients with Gestational Diabetes

Mellitus will develop Type 2 diabetes (T2D) within 5-10 years, especially if obese. (Royle & Walsh 1992; Smeltzer & Bare 1992).

The most prevalent type of diabetes is the T2D and affect people mostly in their later age. It is due to the combination of insulin resistance and defective secretion of insulin by pancreatic beta cells. The condition is a global burden and it is a common endocrine disease found in the world. According to Butt,et. al. (2015), people with diabetes mellitus suffer premature mortalities

Furthermore, other specific types of diabetes may occur due to other causes. They include monogenic diabetes syndromes such as neonatal diabetes and maturity-onset diabetes of the young (MODY), diseases of the exocrine pancreas such as cystic fibrosis, and drug or chemical-induced diabetes such as in the treatment of HIV/AIDS or after organ transplantation, etc. For patients who do not clearly fit into a single category of classification, assigning a type of diabetes often depends on the circumstances present at the time of diagnosis (Diabetes Care, 2015).

Complications of Diabetes Miletus (DM) include diabetic retinopathy, infection, nephropathy, ketoacidosis, diabetic foot ulcer (Holt, 2004). Foot ulcer as a result of diabetes can occur when there is ulceration and there is a neuropathic damage or complete loss of feeling in the foot or leg which often leads to ulceration in the limb amputation. In addition, skin disorders are also common in diabetes (Holt, 2004).

2.1.1 Biological, Medical and Lifestyle Risk Factors

According to scientists, the exact mechanisms that lead to insulin resistance and impaired insulin secretion in Type 2 diabetes are unknown. Genetic factors are said to play a role in the development of insulin resistance. In addition, factors such as age, obesity, stress, depression,

family history and ethnic group have been found as risk factors associated with the development of type 2 diabetes (Bain, 2001; Crowther & Van der Merwe 2001).

A number of factors have been identified as increasing the risk of type 1 diabetes. Risk factors for type 1 diabetes mainly include family history, race and certain viral infections during childhood. Risk factors for type 2 diabetes (obesity, physical inactivity, high blood pressure, advance aging, etc) are more diverse, some are modifiable and others non-modifiable (Van der Merwe 2001).

Additionally, modifiable or lifestyle risk factors include increased body mass index (BMI), physical inactivity, poor nutrition, hypertension, smoking, and alcohol use, among others. One of the strongest risk factors for development of diabetes is increased BMI. Lower levels of physical activity increase a person's risk for diabetes. Also, psychosocial factors such as depression, increased stress, low social support, and poor mental health status are also associated with an increased risk for the development of diabetes (Anjali et al, 2018). On the other hand, non-modifiable risk factors for type 2 diabetes include age, race or ethnicity, family history, that is, genetic predisposition, history of gestational diabetes, and low birth weight. The incidence and prevalence of diabetes increases with age (Anjali et. al, 2018).

2.2 The Global Prevalence of Diabetes

There has been an increase in the prevalence of T2D during the last decades. The World Health Organization (WHO) estimation in 2014 put the figure at about 422 million adults (8.5% of the world's population) compared to 108 (4.7%) in 1980. It is projected to rise to 642 million by 2040 (WHO, 2014). According to Zhang et al., (2010), the estimated worldwide prevalence of diabetes among adults in 2010 was 285 million (6.4%) and this value is also predicted to rise to around 439 million (7.7%) by 2030.

The International Diabetes Federation (IDF) also estimated that 425 million people suffer from diabetes worldwide (IDF, 2017). In the United States of America (USA), type 2 diabetes mellitus affects nearly 16 million people (Faria, Zanetti, & Damasceno, 2013).

A study projected that the incidence of diabetes will tend to rise up 64% by 2025, meaning that an overwhelmingly 53.1 million citizens will be affected by the disease (May, 2013). The effects of diabetes mellitus on mortality and morbidity have drawn the attention of the healthcare community to the need for effective management.

According to the World Health Organisation (WHO), there is an increase in the prevalence of diabetes especially in developing countries due to the epidemiological transition of health risks towards modern risks such as sedentary life style and unhealthy food rather than the health risks associated with communicable diseases (WHO, 2015). The increase in the prevalence of diabetes could also be caused by improved survival and aging of people and improved disease detection and diagnosis (WHO, 2015).

Chronic non-communicable diseases, including diabetes, constitute the leading cause of death globally (WHO, 2013). WHO recent estimates showed that diabetes caused 1.5 million deaths in 2012, constituting 2.7% of total deaths. Majority of diabetes mortality occurred in low and middle-income countries (Eiman, Muna & Abdelmoneim, 2014).

The greatest increase in prevalence is expected to occur in the Middle East Asia, sub-Saharan Africa, and India. It is found that the incidence of type 1 diabetes is increasing globally and especially among younger children (Beran & Yudkin, 2016). It is estimated that there are 300-350 new respondents of diabetes per year among children aged below the age of 15. The incidence has doubled during the last three decades (Seppanen et. al.,2009)

Rapid socio-economic development and the consequent improvement in living standards and changes in lifestyle, have led to a dramatic increase in the prevalence of type 2 diabetes

mellitus. Additionally, the negative tendency towards nutrition and decrease in physical activity have also contributed to the increase in prevalence (Akotey, 2012).

2.2.1 Prevalence of Diabetes in Sub-Sahara Africa

The majority of people with diabetes in low resource nations are adults between the age of 45-64 years (King, Aubert & Herman, 2008), as against the majority of people in the developed world who have diabetes above the age 64 years. It is estimated that, by 2030, the number of people with diabetes below the age of 64 years will be more than 82 million in low resource countries and less than 48 million in developed countries (Wild et al., 2004). The largest increases in the diabetic populations are estimated to be in the most economically productive ages (Bjork et al., 2013). It is found that the prevalence of the disease in Africa is on the rise because of the ageing population and lifestyle changes that come with rapid urbanization. Recent reports show that traditional rural communities still maintain very low prevalence, which is at most 1-2% (WHO 2014). Type 2 diabetes is the most common form (70-90%), the rest being represented by typical type 1 patients and patients with atypical presentations.

Due to modifiable risk factors such as the high urban growth rate, unhealthy dietary changes, reduction in physical activity and increasing obesity, it is projected that the prevalence of diabetes will triple in the next 25 years. Additionally, long-term complications occur early in the course of diabetes and affect many patients, and could be partly explicated by uncontrolled hypertension, poor glycaemic control and possible ethnic predisposition (Bjork et al., 2013).

The blend of the increasing prevalence of diabetes and the high rate of long-term complications of diabetes in Africans is expected to cause a drastic increase of the burden of diabetes on health care systems of the continent. It is therefore, a public health priority that, a

design and implementation of an appropriate strategy for early diagnosis and treatment, and population-based primary prevention of diabetes in these high-risk populations is instituted (Sobngwi et al., 2011). The unidentified complications in diabetes in Africa are in the order of 60% to 80% in respondents diagnosed in Cameroon, Ghana and Tanzania (IDF, 2010). The rate of complication such as limb amputations varies from 1.4% to 6.7% of diabetic foot cases. Mortality associated with diabetes globally is estimated at more than one million (WHO, 2004). In some countries of sub-Sahara, the mortality rate is higher than 40 per 10 000 of the population (WHO, 2005).

2.3 Treatment and Management of Diabetes

Diabetes has no permanent or definite cure; however, various treatments are given to patient to control and management their conditions so that they do not deteriorate. To effectively monitor patients, a thorough knowledge of the medications used to control hyperglycemia is needed.

Diabetes mellitus management includes pharmacotherapy and non-pharmacotherapy such as dietary changes and lifestyle modifications. Pharmacotherapy of T2DM is with either insulin or oral anti-diabetic drugs (OADs), (Ozougwu, 2013). Primary failure with monotherapy has been studied and found to occur within 6 years of the condition. Combinations of two drug classes now are used to control blood glucose levels (Faria et al., 2013). The management at home also requires awareness of the mechanism of action of the different classes of hypoglycemic agents to monitor treatment.

In a study conducted on effect of diabetes drug counseling by the pharmacist, and diabetic education, a total of 360 volunteers with type 2 DM patients were selected. Subjects were categorized into simple randomized 180 to control group and 180 to intervention group. One group received diabetes drug counseling; the other group received plus diabetic education.

Both groups were monitored for fasting plasma glucose and HbA1c at 3-6 months. Glycemic levels in both groups were compared. The most favorable glycemic outcome was the group that received drug counseling and diabetes education. The results showed that drug counseling has little beneficial effect on diabetes management outcome compared to the diabetes management education and drug counseling. Thus, it was recommended that to improve glycemic control of type 2 diabetes mellitus, patients must integrate self-management in daily life, with wide a variety of education on drug taking behaviors by and health care providers. Available communication produces improvement in patient management and is somewhat better when used in combination with medication (Bjork, S., et al., 2013).

A study suggested that dietary advice from health professionals can play a significant part in preventing and managing type 2 diabetes (Haynes, Taylor & Sackett, 2009). Overweight and obesity are strongly associated with this condition and individually tailored advice on weight loss and maintaining an appropriate weight are useful, together with encouragement to take appropriate exercise (Haynes, Taylor & Sackett, 2009). Current thinking about advantages of a healthy diet and lifestyle apply to people with type 2 diabetes.

2.3.1 Diet therapy

Diet is considered an appropriate approach for patients with diabetes mellitus. Dietary modification is required to meet patients' needs and lifestyles. IDF (2006) recommends a conventional approach of diet composed of 60-65 percentage of carbohydrate, 25-35 percentage of fat, and 10-20 percent of protein with little or no drinking of alcohol. Vegetables serve as hypoglycemic agents and are among the numerous plant adjuncts. According to experiments, acupuncture is effective in treating diabetes and preventing future complications as a result of its active agents (Schmitt et al., 2013). Hypoglycemic agent acts

as the pancreas to enhance insulin synthesis, increase the number of receptors on target cells. The acupuncture also increases the use of glucose ensuring lowering blood glucose. The agent has an anti-obesity effect which is a risk factor for type 2 diabetes. Additionally, it has a major therapeutic effect which acts on multiple organ systems in reducing the glucose level. Hot tub is recommended for T2D patients who are not able to exercise since it has effects on skeletal muscles and also aid in reduction in weight (Schmitt et al., 2013)

2.4 Adherence among Diabetes Patients

This section of the chapter reviews literature on adherence among diabetes patients. Specifically, it focuses on adherence in terms of diet and exercise as part of diabetes management. Most health care providers instead of “compliance” use the term “adherence”, although these concepts are quite different. Adherence has been defined as “the extent to which a person's behavior coincides with medical advice (Haynes, Taylor & Sackett, 2009). Non-adherence then essentially means that patients disobey the advice of their health care providers. Patient non-adherence is attributed to personal qualities of the patients, such as forgetfulness, lack of will power or discipline, or low level of education (Gundala, Sastry, Manmohan, & Geeta, 2016). The concept of non-adherence not only assumes a negative attitude of health care providers toward patients, but also places patients in a passive, unequal role in relationship to their care providers.

Adherence has been defined as the “active, voluntary, and collaborative involvement of the patient in a mutually acceptable course of behavior to produce a therapeutic result (Meichenbaum & Turk, 1987). Implicit in the concept of adherence is choice and mutuality in goal setting, treatment planning, and implementation of the regimen. Patients internalize treatment recommendations and then either adhere to these internal guidelines or do not adhere (Gundala et al., 2016). However, the concept of adherence has been criticized because

of its focus on patients and because of the nature of the diabetes regimen itself, which is dynamic rather than static (Glasgow & Anderson, 1999). Furthermore, it is not useful to think of adherence as a unitary construct, but rather one which is multidimensional, because patients may adhere well to one aspect of the regimen but not to others. Non-adherence to prescribed drugs, exercise, diet schedule has been and continues to be a major problem the world over (Faria et al., 2013).

Diabetes is considered to be one of the most psychologically and behaviorally demanding of the chronic diseases. It requires frequent self-monitoring of blood glucose, dietary modifications, exercise, and administration of medication on schedule. Studies have emphasized the importance of achieving optimal glucose control through strict adherence to medications, diet, and exercise in order to minimize serious long-term complications (Gundala et al., 2016). These complications affect the patient's quality of life, increase mortality, morbidity and economic cost to society. It is imperative that patients adhere to their prescribed regimens to minimize the burden of the disease on the health systems. Non-adherence in chronic diseases has been described as taking less than 80% of the prescribed treatment (African Health Science, 2008).

2.4.1 Dietary and Exercise Adherence among Diabetes Patients

It has been generally acknowledged for years that non-adherence rates for chronic illness regimen and for lifestyle changes are 50% (Haynes, Taylor & Sackett, 2009). Patients with diabetes are prone to substantial regimen adherence problems (Kurtz, 1990). Research has shown that the diabetes regimen is multidimensional, and adherence to one regimen component may be unrelated to adherence in other regimen areas (Kravitz, 1993). For instance, studies have shown better adherence for medication use than for lifestyle change

such as diet and exercise (Anderson, Fitzgerald & Oh, 1993). In other studies, adherence rates of 65% were reported for diet but only 19% for exercise (Haynes, Taylor & Sackett, 2009).

2.5 Prevalence and Factors associated with adherence to dietary and exercise regimen

Adherence or non-adherence to prescribed diabetes management procedures is affected by numerous factors some of which could be patient's reluctance, forgetfulness, environmental or household factors, availability and accessibility to required procedures among other things. Various studies on adherence particularly on dietary and exercises have been reviewed here.

In a study carried out in Yemen, Hodeidah city, it was found that only 21.0% of patients adhered to the recommended diet and 15.0% adhered to regular exercise. These rates were consistent with the findings of similar studies in neighboring countries such as Jordan, and Kuwait, where the rate of adherence to diet varied between 10.7% and 36.5% (Shokair, 2007; Serour, Alqhenaei & Al-Saqabi, 2007). However, the rates of adherence to physical exercise found in these studies varied between 9.5% and 35.6% (Shokair, 2007; El-Abbassy, 2015).

Reasons reported from these studies as contributing to adherence in Yemen was that most people eat together in groups with the family members and friends. Thus, in societies where communal living is common or where families do things together, it may be difficult for such patients to follow their special diet regimen that is different from the rest of the family. The study also showed that urban residents adhered to diet almost twice higher than rural residents (Alhariri, Daud, Almaiman, Ayesh, & Saghir, 2017). This finding is in contrast to that reported among diabetics from Bangladesh (Mumu, Saleh & Ara, 2015), where rural patients were three times more likely to adhere to prescribed diet than urban patients. This difference may be due to the lack of DM health care services and education in rural areas or the rate at which people do things together in the urban areas, may be lower than the rural areas. Demographic factors such as low level of education and the type of occupation have

been found to be associated with lowered adherence and greater diabetes related morbidity (Delamater, 2001). For example, lower rates of adherence have been observed among minority African-American and Mexican-American patients (Harris, 1999).

In another study, a report on the analysis done according to groups showed employed patients and housewives were four times more likely to adhere to diet than the unemployed ones (Gundala et al., 2016). This finding is consistent with a previous study in Bangladesh (Mumu, Saleh & Ara, 2015), where employees were more adherent to diet than unemployed patients. This may be due to differences in knowledge level and economic status, which are usually better among employees. In addition, it is also supported by a study conducted in Oman (Al-Sinani, Min & Ghebremeskel, 2010), which revealed that women were more amenable to changing their diet than men. Several other studies, have found gender difference in terms of adherence to diet and exercises. Where women are found to be more adherent to diet, men are also found to be more adherent to exercises. Consistent with other studies (El-Abbassy, 2015), patients with DM duration of ≤ 5 years in the study were more adherent to diet than those who had a duration of >5 years. This may imply that more years of the condition may lead to apathy and negligence on the part of some patients.

The age distribution of patients has also been found to have a significant influence on adherence. Studies have indicated that younger age was significantly associated with adherence to physical exercise (Mumu, Saleh & Ara, 2015; Alrahbi, 2014). In fact, with increasing age, a decline in motor abilities and comorbid disease can occur, that makes it difficult to perform routine physical exercises. Patients who were treated with oral hypoglycemic medications were more engaged in physical exercise than those who were treated with insulin. A similar study in Saudi Arabia (Khan, Al-Abdul Lateef & Al Aithan, 2012), rather found that using insulin was significantly associated with adherence to diet. The various studies provide the evidence that there are multiple factors contributing to these

findings, which require a further investigation in the subject matter, particularly in the sub-Saharan Africa.

Findings related to metabolic control such as HbA1c showed a significant association with the rate of adherence to healthy diet and physical exercise (Serour, Alqhenaei, Al-& Saqabi, 2007; Shamsi, Shehab & AlNahash, 2013), indicating that good diabetes control is significantly higher in those following a diet and taking regular exercise. The low rate of adherence to both diet and exercise found in this study reflect the lack of glycemic control among patients.

Summary

Diabetes is found to have three broad categories which are type 1, type 2 and gestational diabetes. The classification is based on the nature and the occurrence of the condition. The prevalence of diabetes is growing with higher prevalence in low resource countries due to changing lifestyles and the adoption of western lifestyles. Several risk factors contribute to diabetes and these are modifiable risk factors such as lifestyle, example diet, alcohol and physical inability; non-modifiable risk factors include family history, genetics, hereditary among others. There is no permanent cure to the condition but several medications exist to manage the condition. In addition to medications are recommended exercise and diet for diabetics.

Adherence to dietary and exercise regimen among diabetics are found to be influenced by a number of factors. Several studies reviewed found socio-demographic characteristics such as age, employment, sex. Other studies also reported duration of the diseases as a significant factor of adherence to exercise and diet.

Knowledge Gap

The literature review provided above shows that there has been extensive work done by various scholars on diabetes globally. To this extent, knowledge on diabetes in terms of risk factors, etiology, medication is well documented. It must also be acknowledged that in terms of adherence, a lot of studies have been done on medication adherence in international, regional and local contexts. However, it must be noted that literature on effectiveness to diet and exercise as methods of diabetes management is poorly understood. In terms of dietary and exercise adherence among patients, very few works have been done especially in sub-Saharan Africa. Various literature found were on studies mostly done in Asia and America.

CHAPTER THREE

METHODS

3.1 Introduction

This chapter discusses the methods that were used to carry out the study. The chapter includes the study design, study area and population. Methods and procedures for data collection and sampling are also outlined here. In addition, data analysis and management as well as ethical consideration are also described.

3.2 Study Design

The study employed a cross-sectional study design to examine diet and exercise treatment adherence among diabetes patients in the Tema General Hospital (TGH) of the Tema Metropolitan Assembly (TMA), Greater Accra Region of Ghana. Cross-sectional design was considered as appropriate for the study because the study seeks to provide an estimate of the prevalence of non-adherence and non-causal relationship between patient's demographic and clinical characteristics and non-adherence.

3.3 Study Area

The study was conducted at the Tema General Hospital (TGH) of the Tema Metropolitan Assembly, Greater Accra Region of Ghana.

Location / Physical features

The study was carried out at the Tema General Hospital (TGH), located in the Tema Metropolis (Figure 3.1). Tema metropolis is one of the 16 districts in Greater Accra Region and is a vibrant commercial and industrial city. The population of Tema metropolis was estimated at 403,934 projection from 2010 population census (GSS PHC., 2012), making it the second largest populated district in the Greater Accra Region. The estimated 2016 population of Tema Metropolis is 351,616 as projected from the 2010 Census, making it the

second largest-population of the ten districts in the Greater Accra Region, after Accra Metropolis. TGH was constructed in 1954 by J.W Harrow and Sons Ltd and later handed over to the government of Ghana in 1965.

Tema Metropolis is a coastal district situated about 30 kilometers East of Accra, the Capital City of Ghana. Its unions boundaries in the northeast with the Dangme West District, south-west by Ledzokuku Krowor Municipal, north-west by Adentan Municipal and Ga East Municipal, north by the Akuapim South District and south by the Gulf of Guinea. The Metropolis covers an area of about 87.8 km with Tema as its capital. The metropolis lies in the coastal savannah zone.

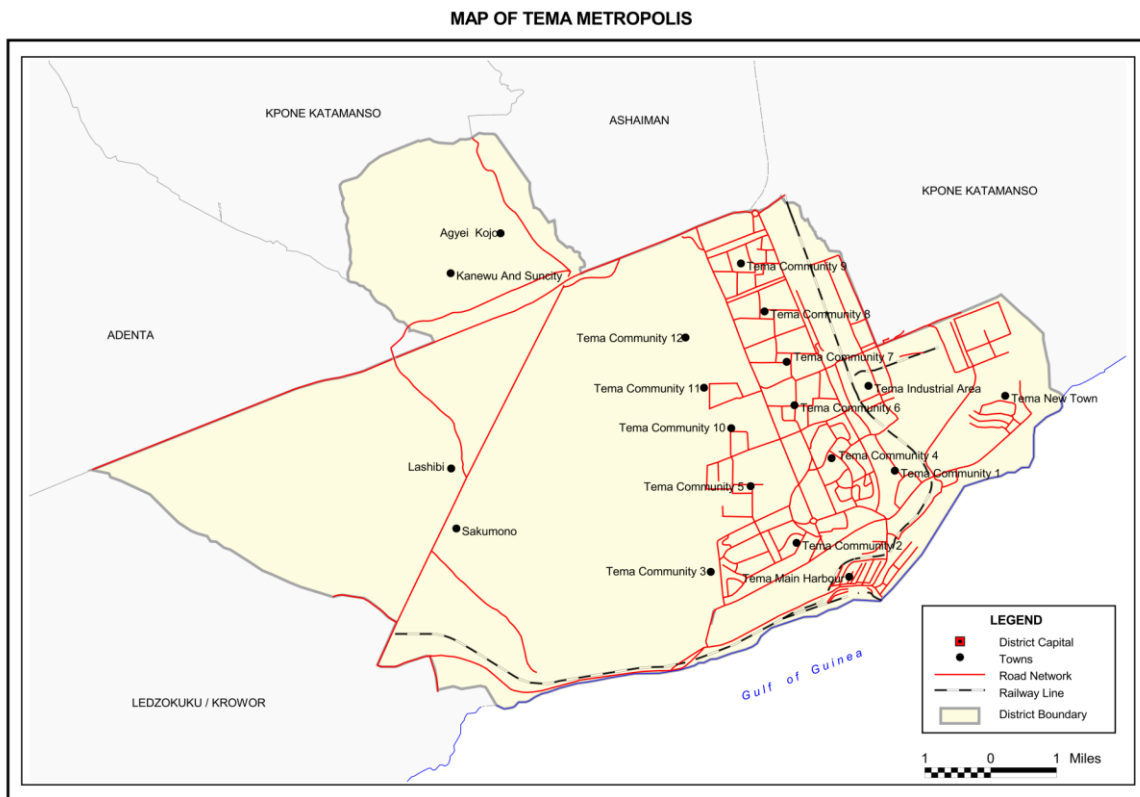


Figure 2: Map of Tema Metropolis
Source: GSS, 2010

3.3.1 Tema General Hospital

The Tema General Hospital is the largest public health institution in the Tema Metropolis, which promotes, protects and ensures good health and well-being of its clients and the community at large. The geographical location of the Hospital is surrounded by road networks, making the hospital the major referral points for all other clinics/ hospitals, public and private in and around the Metropolis. The catchment area includes the whole of Tema metropolis, its satellite town and villages. The Tema General Hospital has ten (10) wards and between 280 and 300 bed capacity, (District Analytical Report, 2014).

There are several departments at the TGH of which the diet therapy unit is included. Other departments include surgical, dental, physiotherapy and eye (Tema metropolitan, 2013). The hospital delivers medical services to both in-patients and out-patients. Diabetes mellitus appears to be among the top (10) commonest conditions at the TGH. For the past 3 years there has been increase in hospital attendance of diabetes mellitus patients at the diabetic clinic and the diet therapy unit at the Tema General Hospital (GHS-Report, 2013).

The study area was selected due to the high patients' attendance at the diet therapy unit and its wide catchment area. The diversity of the population would be helpful for the external validity of findings of the study. This was because of the opportunity to make selection from different group of persons having the condition.

The facility renders services to all the communities within the Tema metropolis such as Nungua, Teshie, Spintex, Sakumono, Tema New town, Manhean, Ashaiman and Afienya, among others.

3.3.1.1 The Diabetes Clinic

The diabetes clinic at the TGH serves over thousand patients in a year. However, it has clients of other private hospital who attending the clinic because of the fact the TGH is the main referral center. The client population has also grown steadily over the years. The diabetic clinic has six (6) staff comprising of four (4) nurses, a doctor and one record officer. Clients from the diabetes clinic are mostly referred to the diet therapy unit to see the dietitian.

3.3.1.2 The Diet Therapy Unit

The diet therapy unit of the TGH also serves clients being referred within and out of the hospital. The diet therapy unit clinic has four (4) staff comprising a dietitian, two (2) nurses, and one record officer. The diet therapy unit has been able to capture information on diabetics with comorbidities such as hypertension, number of amputations, new diabetes patients, and people living with diabetes less than 40 years and mortalities but unfortunately, information has not been captured on non-adherence to dietary and physical exercise recommendations among diabetes patients. However, there is the need to identify the prevalence of adherence among clients with T2DM at TGH.

3.4 Study Population

The target population was all patients with type 2 diabetes attending the diet therapy of the Tema General Hospital (TGH). The study population were patients diagnosed with type 2 diabetes, who have been seeing the dietitian for more than 2 months and have been given meal plans to follow.

3.4.1 Inclusion criteria

- Age greater than or equal to 18 years,
- Have sound cognitive and hearing capacities preserved
- Male and female with type 2 diabetes mellitus

- Patients who had complete clinical records in the hospital.
- Being regularly monitored in the hospital selected for the study.
- Patients who attended the diet therapy unit for at least 2 months.
- Patients who would consent to be part of the study.

3.4.2 Exclusion criteria

- Patients with type 1 diabetes
- Patients with incomplete records or missing information

3.5 Study Variables

The study variables consist of independent and dependent variables that were used to satisfy the research questions.

3.5.1 Independent Variables

The effects of certain factors, which may influence non-adherence to treatment regimen (diet and exercise), were explored in this study. Socio-demographic factors, knowledge about treatment regimen and clinical factors were the explanatory variables under consideration in this study, and these are aligned with the study's conceptual framework. The socio-economic status of the participant is categorized as poor or rich using the national poverty line of ₵1314. A participant is considered poor if the average income is less than the National poverty line (GSS, 2018).

Table 1: Definition of Independent Variables

Variables	Definition	Type of data
Age	Age at last birthday	Ordered categorical
BMI	Quotient of body mass and height squared	Ordered categorical
Marital status	Whether married or single	Unordered categorical
Educational status	Last education attained	Unordered categorical
Socio-economic status	Measured using the average income against the National Poverty line estimate of ₵1314 per day.	Binary
Duration of disease	how long participant was diagnosed of diabetes	Categorical
Family history	Any family member diagnosed with diabetes	Binary
Comorbidities	Participant diagnosed of other conditions	Categorical
Glycemic level	Amount of glucose in blood	Continuous
Blood pressure	Sphygmomanometer reading of blood pressure	Continuous
Smoking status	Whether the participant smokes or not	Binary
Alcohol consumption	Whether the participants take alcohol	Binary
Food frequency	Item of food lists with response categories to indicate how often the food is consumed in a month	Unordered categorical

3.5.2 Dependent Variable

The dependent variable was the outcome of interest to the study which were adherence or non-adherence to exercise and dietary recommendation. These were measured using treatment adherence scale described in detail below.

Adherence to physical exercise recommendation is an item composite variable measuring whether the participant is engaged in some form of exercise, whether the participant is committed to the exercise, whether the participant has ample time to do the exercise, whether the exercise schedule is recommended by a professional and whether the exercise is routine. Responses from these items are scored as a summation of responses from the 15 items and the highest response of 45 and a minimum score of 15 could be obtained for a participant. A

participant is adherent to physical exercise recommendation if the participant scored above 30. Adherence to dietary recommendation is a 5 item composite variable measured as the number of times a participant eats in a day, the interval of eating in a day, whether the participant takes some snacks between meals. Correct responses to each item are coded as 1 while wrong responses are scored 0. The maximum score a participant can obtain is 5 while the minimum score is 0. A participant is considered adherent if the participant scored more than 2 for the responses to dietary recommendations.

Table 2: Definition of Dependent Variables

Variables	Definition	Measurement
Adherence to physical recommendation	15 item composite variable measuring how often a participant exercises in a day,	Binary
Adherence to dietary recommendation	5 item variable measuring how often a participant eats in a day,	Binary
Knowledge on Diabetes condition	5 item composite variable on diabetes	Binary

3.6 Sample Size determination

Assumptions

Based on data available at the diabetes clinic and the diet therapy unit of the TGH, this study had a closed cohort of 275 participants with T2DM. Looking at the inclusion criteria and the time for completion, new admissions could not be included in the study. Since this study was interested in assessing predictors of increased risk of non-adherence to exercise and meal plans, there was the decision to conduct a power calculation instead of a sample size calculation given the closed cohort. In line with the literature on increased risk for non-adherence, the primary hypothesis was that patients from a low socio-economic status are more likely to report low adherence to exercise or meal plans, compared to those with high socio-economic status. The study also had secondary hypothesis in terms of the relationship

between other predictors (clinical, metabolic) and non-adherence but the decision was to use the minimum prevalence approach to ensure that models have adequate power to detect differences in the other predictors. Based on previous literature, this study assumed a ‘control’ (patients with high socio-economic status) prevalence of 45% non-adherence and a ‘comparison group’ (patients with low socio-economic status) prevalence of 65% non-adherence.

Based on these assumptions and using the Stata command; *power two proportions 0.65 0.45, n (275)*, the sample size of 275 was sufficient to detect a prevalence difference of 20% with a power of 92%.

3.6.1 Sampling Method

Consecutive sampling was used to select the study participants for the study until the sample size of 275 was met. The sampling consisted of diabetes patients with records with the hospital. The selected records were matched with patients when they visited the center for their routine check-ups for additional data to be collected.

Patients were recruited as and when they visited the clinic and interviewed by answering questions on the questionnaire as they queued and waited for the clinic to commence or as they waited to see the doctor/dietitian. Further information was also taken from their records at the hospital as discussed. Administering of the questionnaire continued until the total number of sampled patients’ records at the diet therapy unit was achieved

3.7. Data Collection procedure

Data collection was conducted in July, 2019 by trained field research assistants. Period for data collection lasted 2 weeks; from the second week through to the third week of July. Each day it was expected to have an average of 20 respondents. Therefore, for 275 sample size, data collection was estimated to take up to approximately 14 days.

The data collection took place at the hospital where patient records were obtained. The following data were collected: blood pressure, body weight and height (which were used to calculate BMI) and laboratory tests from history or records. Primary data such as blood pressure and weight were collected on the day of interview. Laboratory tests such as fasting blood sugar, random blood sugar, glycated hemoglobin (HBA1C), and lipid profile among others were obtained from history or records. The next step consisted of conducting structured interviews with the patients when they visited the diet therapy unit. Information obtained included their adherence to exercise and dietary recommendation and any data that were not obtained from the records.

Each participant was interviewed by either the researcher or assistants who explained the contents of the questionnaire to their understanding.

Questionnaires were self-administered. However, research assistants administered the questionnaires to the respondents who were not able to read and write. Respondents were requested to consent either verbally, signing or thumb printing. Before and during the interview, respondents who did not understand any item on the questionnaire were allowed the freedom to ask questions for clarification. Respondents who felt uncomfortable to continue with the interview for whatever reason were free to opt out.

3.8 Data Collection Tools

The instruments that were used for the data collection were background information form, food consumption frequency and exercise adherence rating scale.

3.8.1 Background Information form

The questionnaire contained socio-demographic variables (sex, age, education and family income (used to estimate socio-economic status), clinical variables (time since diagnosis,

comorbidities, and chronic complications) and metabolic control variables (Body Mass Index – BMI, blood pressure and laboratory tests).

3.8.2 Food consumption frequency questionnaire

This tool assessed the food consumption patterns and behavior among diabetes patients in order to determine their adherence to diet regime. This tool was modified as a Likert scale. The responses were ordered categorical. The categories are 3. Never was coded “0” Sometimes was coded “1” and always was coded “2”. The food frequency questionnaire was made up of 45 food items categorized under fish, starches, soup, stew, fruits, porridge, vegetables milk products and spreads

3.8.3 Knowledge measurement scale

Knowledge was measured as a composite variable made up of 5 items. A correct response to an item was coded 1 while a wrong response was coded 0. Where participant obtained a score less than 3, the participant was considered less knowledgeable while a score above 2 was considered knowledgeable.

3.9 Ethical Considerations

The study followed national and international standards of ethics in research involving human beings. Ethical clearance was sought from the Ghana Health Service Ethics Review Board. Consents were also sought from the appropriate authorities of the hospital and the Tema Metropolitan Assembly (TMA).

Consent of the participants was sought before data was collected. Voluntary participation was indicated by signing or thumb printing a written informed consent form by each study participant. The purpose of the study, the benefits and rights of the subjects and the procedure involved were explained to all participants. All information provided by the respondents was

kept confidential and data locked in a safe place and softcopy store and protected on computers. Electronic data files were secured by a password known by only the principal investigator. Research assistants could only access them when they had been given permission

Participants were given the right to refuse to answer questions that they were not comfortable with. They also had the right to withdraw from the study at any time they do not feel comfortable to continue. They were assured of confidentiality with regard to all information they provided and were encouraged to fully participate. All responses obtained were kept private and confidential. Respondents were not paid for their direct involvement in the research. This was done to avoid biases in their response.

3.9.1 Benefits

Patients who participated in the study had the opportunity to be educated on the importance and benefits of exercises and balanced diet in the management of type 2 diabetes. Also, respondents who needed special attention in the course of the study in terms of diet or exercise management were referred appropriately.

3.9.2 Training of Interviewers

Training was organized for three research assistants who could speak some of the local languages to administer the questionnaires to participants at the Tema Metropolitan Assembly. The research assistants were trained on the interpretation of questions and how to administer the questionnaire. The training was for a period of two working days with the second day used on the field for practical experience during the pretesting. This was to ensure that the interviewers understood the questions and be able to provide the same interpretation to the questions. It also helped them to learn how to administer the questionnaires and how to examine them for inconsistencies and completeness.

3.9.3 Quality Assurance

3.9.4 Pre-Test of Instruments

The study tools were the background information form and the adherence rating scales. The questions were both open-ended and close-ended. The tools were pre-tested at the Tema poly clinic on patients with similar characteristics. The selected participants for the pre-testing of the instruments were not part of the main study. Corrections and modifications were made and the final questionnaire and other tools prepared.

3.9.5 Data Analysis

All completed questionnaires were cross-checked before they were included in the valid responses. Data was coded and entered into Microsoft Excel. The entered questionnaire was marked, numbered and put into labeled envelopes and stored safely. All statistical analyses were performed using STATA version 15 (*StataCorp.2007. Stata Statistical Software. Release 15. StataCorp LP, College Station, TX, USA*). Microsoft Excel 2016 was used to enter the data.

For data analysis, descriptive statistics were used in order to determine the prevalence of adherence to treatment (with 95% CI) and characterization of the sample regarding socio-demographic and clinical variables. For the analysis of values obtained from the 5 item composite for adherence to dietary recommendation, which is measured as the number of times a participant eats in a day, the interval of eating in a day and whether the participant takes some snacks between meals, a participant is considered adherent if the participant scored more than 2 for the responses.

For the analysis of values obtained from the 15 items on adherence to physical exercise recommendation, which measured whether the participant is engaged in some form of exercise, whether the participant is committed to the exercise, whether the participant has

ample time to do the exercise, whether the exercise schedule is recommended by a professional and whether the exercise is routine, a participant is considered adherent to physical exercise recommendation if the participant scored above 30. To investigate the relationship between adherence to treatment and socio-demographic, clinical and metabolic control variables, the data was analyzed using chi-square test. The quantification of this association was measured by logistic regression models, because outcomes were regrouped into binary outcome which make logistic regression the more preferred option. The crude Odds Ratio (OR) and the Adjusted Odds Ratio (AOR) were calculated with its respective confidence interval of 95% for each variable in relation to adherence. Values of $p < 0.05$ were considered significant.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter presents the results from the study. The results presentation follows the order of the study objectives with the demographics and the clinical profile of the respondents preceding the chapter. Analysis done followed the three stages of analysis which are the descriptive, bivariate and logistic regression. In all, 275 participants' data were used in the analysis.

4.2 Demographic profile of respondents

The average age of respondents was 45 years +14.36 and ranges from 18 to 78 years old. The age group categories of the respondents were below 30 years old (14.3%), 30 to 40 years (24.2%), 41 to 50 years (24.5%) and above 50 years (37.0%) (Table 3). Compared to all the other age groups, respondents who were above the age of 50 years were the majority. Males constituted more than half of the total sample (54.6%) whilst females were 45.4%. Furthermore, the marital status of respondents shows married respondents as the majority (56.8%) followed by widowed (27.1%). Those who were single and those divorced or separated were less than 14%. As shown in Table 3, the major educational levels recorded were basic to JSS, and vocational/technical schools (35.9 and 32.2% respectively).

In terms of occupation, most of the respondents were self-employed (52.7%) followed by those on retirement (26.7%). Akan and Hausa were the major group (little above 28%) and Christians form the dominant religion (69.6%).

Table 3: Background Characteristics of Participants

Variables	Frequency	Percentage
Age group		
Below 30	39	14.3
30-40	66	24.2
41-50	67	24.5
Above 50	101	37.0
Sex		
Female	124	45.4
Male	149	54.6
Marital Status		
Married	155	56.8
Single	33	12.1
Divorced/Separated	11	4.0
Widowed	74	27.1
Education status		
No formal	20	7.3
Basic/Primary/JSS	98	35.9
Vocational/Tech	88	32.2
Secondary/ High school	33	12.1
Tertiary	34	12.5
Socio-economic status		
Poor	161	58.97
Rich	112	41.03
Place of residence		
Rural	4	1.5
Urban	269	98.5
Employment status		
Public sector work	14	5.1
Private employee	18	6.6
Self-employed	144	52.7
Unemployed	12	4.4
Student	12	4.4
Retired	73	26.7
Ethnicity		
Akan	78	28.6
Ga/Adangbe	3	1.1
Krobo	38	13.9
Ewe	19	7.0
Hausa	79	28.9
Others	56	20.5
Religion		
Christian	190	69.6
Muslim	83	30.4

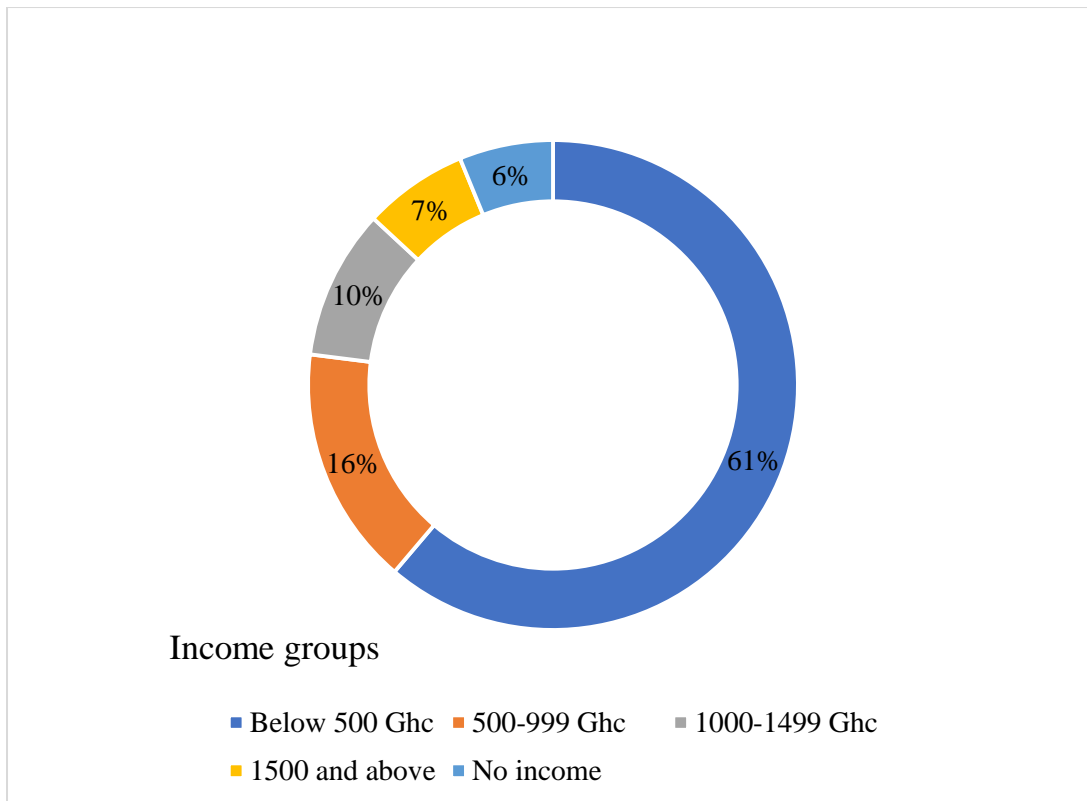


Figure 3: Monthly income levels of Participants

Figure 3 shows the monthly income of participants and as shown, those with income below Ghc 500.00 were the majority (61%), which was followed by those with income group of between 500 and 1000 Ghc and between 1000 and Ghc 1,500.

4.3 Clinical and personal lifestyle factors of respondents

This section presents the results on clinical factors as well as personal life style factors of participants. This has been descriptively analyzed and presented in tables and graphs.

Table 4: Clinical profile of participants/respondents

Variable	Frequency	Percentage
Duration of disease		
Less than 6 months	18	6.6
6 months- 11 months	24	8.7
1-2 years	21	7.8
3-5 years	165	60.4
6-9 years	22	8.1
10 years and above	23	8.4
Family history of diabetes		
Yes	173	63.4
No	100	36.6
BMI		
<18.5 (underweight)	22	8.1
18.5-24.9 (normal/healthy weight)	144	52.8
25-29.9 (overweight)	76	27.8
>30 (obese)	31	11.4
HbA1c		
<6.5	40	14.7
6.5 above	222	81.3
Missing	11	4.0
Regular blood glucose check-up		
Yes	263	96.3
No	10	3.7
First knowledge of diabetes		
Before coming to clinic	30	11.0
During routine medical checkup	243	89.0
Type of treatment		
Drug only	243	89.0
Insulin only	3	1.1
Drug and insulin	13	4.8
Drug and diet therapy	14	5.1
On herbs therapy		
Yes	56	20.5
No	217	79.5

Table 4 provides the detailed results on the clinical factors to the respondents studied. It is observed that the majority have had the condition (Type 2 diabetes) between 3-5 years (60.4%). Those less than 3 years were 15.3% whereas those with the condition more than 5 years formed 16.5%. Those who had family history of T2D constituted 63.4% whilst 36.6% had no family history of diabetes.

In term of their BMI, more than half (52.9%) had between 18.5-24.9 (normal weight) followed by those overweight (27.8%). The underweight group and those obese were 8.1%

and 11.4% respectively. Additionally, high proportion of the respondents had their HbA1c level greater than 6.5 (81.3%).

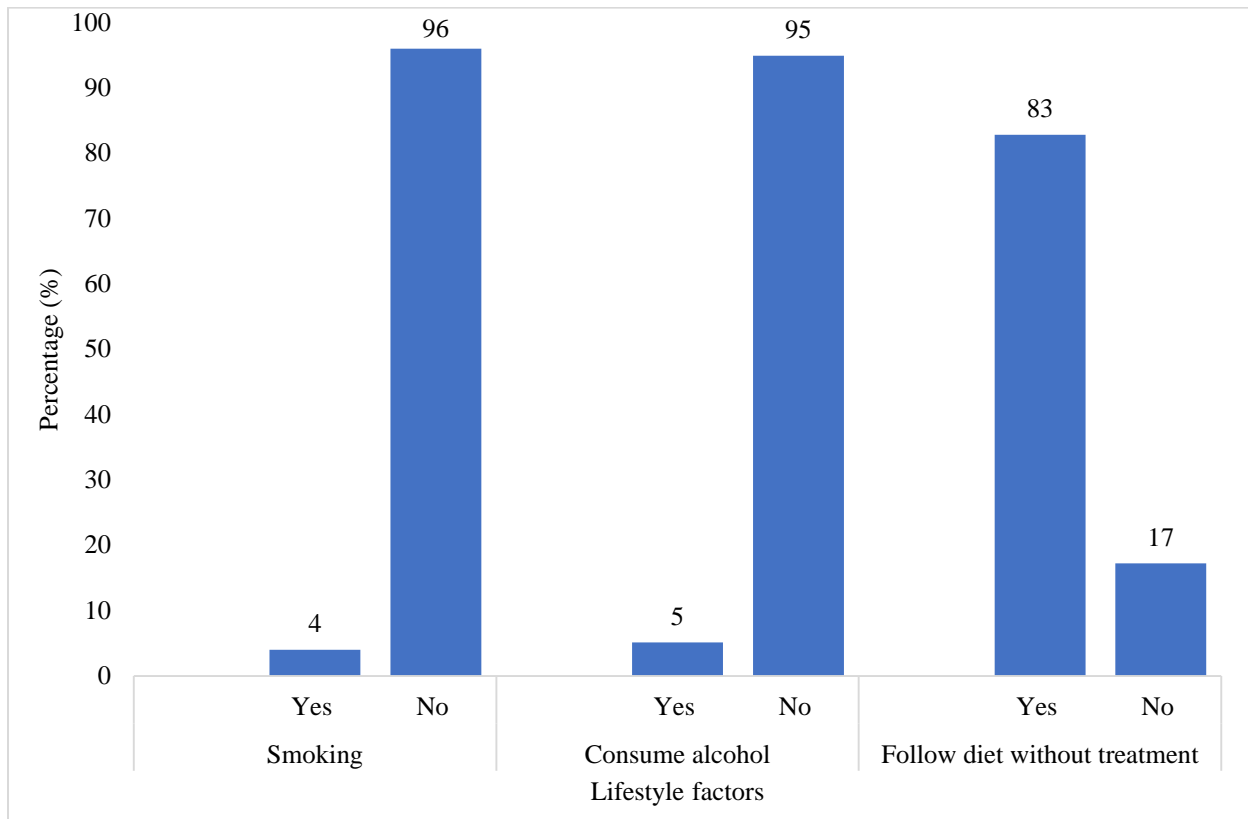


Figure 4: Personal lifestyle factors of respondents

As shown in Figure 4, presents the lifestyle of participant while with diabetic condition. The proportion of respondents who are non-smokers was high. Almost all the respondents (96%) were non-smokers except 4%. Alcohol consumption was also low (5%) and about 83% indicated following diets.

4.4 The level of knowledge on the role of dietary and exercise requirements among T2D

Diet and exercise play an important role in the management of T2D. In this study, participants were examined to describe their knowledge on dietary and exercise requirements.

Table 4.3 provides the details.

Table 5: Knowledge on the importance of diet and physical exercise

Variables	Yes	No	Not sure
Conditions of diabetic patients can be improved by adhering to exercise and physical	210 (76.9)	10 (3.7)	53 (19.4)
Skipping prescribed dietary regimen may not help to improve condition	253 (92.7)	8 (2.9)	12 (4.4)
Eating food in large quantity that should be taken in little quantity is harmful to you	253 (92.7)	8 (2.9)	12 (4.4)
Eating foods that one should avoid/limit is harmful to your condition	187 (68.5)	8 (2.9)	78 (28.6)
Good general knowledge of dietary and exercise regimen could lead to consistent modification and awareness for the patient	200 (73.3)	17 (6.2)	56 (20.5)

From Table 5, participants showed considerably good knowledge on the role diet and physical exercise on the management of T2D. That is 76.9% indicated in agreement that conditions of diabetic patients could be improved by adhering with exercise and exercise recommendations. However, 19% of these respondents indicated they had no knowledge conditions of diabetic may improve with exercise. In addition, majority of respondents indicated that skipping prescribed dietary regimen might not help to improve their condition. Similarly, 68.5% also agreed to the statement that eating foods that one should avoid is harmful to their conditions.

4.4.1 Factors associated with knowledge level among respondents

Responses from participants were classified into good and low knowledge and the test of association was determined using socio-demographic characteristics. The score of those who responded correctly as well as wrongly were computed. The results showed that the majority of 68.1% had good knowledge of the role of diet and exercise on T2D managements whereas 32.9% had low knowledge.

Table 6 shows the results on the test of relationship between demographic factors and knowledge level among participants. Age group was significant ($p < 0.001$), gender was found statistically significant ($p < 0.001$), marital status was associated with knowledge ($p < 0.001$) and educational status of participant was associated too ($p < 0.001$). Similarly, employment status, ethnicity, religion, income levels were also statistically significant at $p < 0.05$. Among all the socio-demographic variables, only place of residence was found to be not significant with a p-value of 0.097.

Table 6: Background factors associated with knowledge

Variables	Knowledge level		P-value
	Poor (N=87)	Good (N=186)	
Age group			
Below 30	18 (20.69)	21 (11.29)	<0.001*
30-40	21 (24.14)	4 (2.15)	
41-50	7 (8.04)	60 (32.26)	
Above 50	41 (47.13)	60 (32.26)	
Sex			
Female	72 (82.76)	52 (27.96)	<0.001*
Male	15 (17.24)	134 (72.04)	
Marital Status			
Married	52 (59.77)	103 (55.38)	0.009*
Single	16 (18.39)	17 (9.14)	
Divorced/Separated	0 (0.0)	11 (5.91)	
Widowed	19 (21.84)	55 (29.57)	
Education status			
No formal	19 (21.84)	1 (0.54)	<0.001*
Basic/Primary/JSS	15 (17.24)	82 (44.09)	
Vocational/Tech	46 (52.87)	42 (22.58)	
Secondary/ High school	0 (0.0)	33 (17.74)	
Tertiary	7 (8.04)	27 (14.52)	
Socio-economic status			
Poor	50 (57.47)	111 (59.68)	0.730
Rich	37 (42.53)	75 (40.32)	
Place of residence			
Rural	3 (3.45)	1 (0.54)	0.097
Urban	84 (96.55)	185 (99.46)	
Employment status			
Working	68 (78.16)	108 (58.06)	0.001*
Not working	19 (21.84)	78 (41.94)	
Ethnicity			
Akan	16 (18.39)	62 (33.33)	<0.001*
Ga/Adangbe/Krobo	0 (0.0)	41 (22.04)	
Ewe	15 (17.24)	4 (2.15)	
Hausa	0 (0.0)	79 (42.47)	
Others	56 (64.37)	0 (0.0)	
Religion			
Christian	87 (100.00)	103 (55.38)	<0.001*
Muslim	0 (0.0)	83 (44.62)	
Monthly Income			
Below 500 Ghc	60 (68.96)	107 (57.53)	<0.001*
500-999 Ghc	8 (9.19)	35 (18.82)	
1000-1499 Ghc	1 (1.15)	26 (13.98)	
1500 and above	1 (1.15)	18 (9.68)	
No income	17 (19.54)	0 (0.0)	
Duration of disease			
2 years and below	0 (0.0)	63 (33.87)	<0.001*
3-5 years	32 (36.78)	12 (6.45)	
Above 5 years	55 (63.22)	110 (59.14)	

Note: *-Measured association is significant; test of association using Fisher's Exact

correction

Table 7 Binary logistic regression: background factors associated with knowledge

Variable	COR	P-Value	AOR	P-value
Age group				
Below 30	1		1	
30-40	1.57 (0.71-3.44)	0.264	3.50 (0.66-18.62)	0.141
41-50	5.39 (2.09-13.88)	<0.001	4.77 (0.95-23.94)	0.057
Above 50	1.00 (0.49-2.06)	0.990	1.57 (0.43-5.74)	0.492
Marital Status				
Married	1		1	
Single	1.22 (0.54-2.75)	0.636	1.50 (0.25-8.87)	0.656
Divorced/Separated	5.53 (0.69-44.33)	0.107	5.02 (0.25-102.56)	0.294
Widowed	1.33 (0.72-2.45)	0.365	0.04 (0.65-1.91)	0.226
Sex				
Female	1		1	
Male	5.67(3.2-10.03)	<0.001	4.25 (1.36-13.35)	0.013*
Employment status				
Working	1		1	
Not working	0.03 (0.003-0.32)	0.001	0.46 (0.05-4.39)	0.501
Ethnicity				
Akan	1		1	
Ga/Adangbe/Krobo	0.67 (0.06-7.73)	0.746	0.32 (0.01-17.14)	0.572
Ewe	5.67 (1.25-25.63)	0.024	4.07 (0.60-27.78)	0.152
Hausa	0.11 (0.04-0.34)	<0.001	0.03 (0.01- 0.29)	0.002*
Others	3.23 (1.29-8.14)	0.012	1.22 (0.28-5.38)	0.792
Religion				
Christian	1		1	
Muslim	17.00(5.17-55.85)	<0.001	2.89 (0.56-14.93)	0.204
Monthly Income				
Below 500 Ghc	1		1	
500-999 Ghc	1.27 (0.65-2.47)	0.488	0.37 (0.09-1.49)	0.163
1000-1499 Ghc	3.38 (0.96-11.91)	0.058	2.86 (0.05-158.02)	0.608
1500 and above	10.13 (1.32-77.69)	0.026	11.83 (0.66-211.78)	0.093
Duration of disease				
2 years and below	1		1	
3-5 years	1.76 (0.65-4.75)	0.263	2.82 (0.22-36.42)	0.427
Above 5 years	0.95 (0.33-2.68)	0.926	1.06 (0.48-4.39)	0.954

4.5 Level of non-adherence to physical exercise among type 2 diabetes patients

As part of the objective of this study, participants were examined to determine their levels of adherence to physical exercises. Results contain the descriptive presentation of findings as well as test of association and multivariable logistic regression of non-adherence.

Table 8 presents adherence to physical exercise recommendation.

Table 8: Adherence with physical exercises among T2D

No	Items	Never	Sometimes (1-3x a week)	Always (≥4x a week)
1	I do my exercises as often as recommended	9 (3.3)	174 (63.7)	90 (33.0)
2	I adjust the way I do my exercises to suit myself	11 (4.0)	249 (91.2)	13 (4.8)
3	I don't get around to doing my exercises	44 (16.1)	226 (82.8)	3 (1.1)
4	Other commitments prevent me from doing my exercises	77 (28.2)	196 (71.8)	0 (0.0)
5	I feel confident about doing my exercises	12 (4.4)	194 (71.1)	67 (24.5)
6	I don't have time to do my exercises	41 (15.0)	186 (68.1)	46 (16.9)
7	I'm not sure how to do my exercises	197 (72.2)	76 (27.8)	0 (0.0)
8	I do some, but not all, of my exercises	48 (17.6)	217 (79.5)	8 (2.9)
9	I don't do my exercises when I am tired	18 (6.6)	71 (26.0)	184 (67.4)
10	I do less exercise than recommended by my healthcare professional	20 (7.3)	206 (75.5)	47 (17.2)
11	I fit my exercises into my regular routine	24 (8.8)	177 (64.8)	72 (26.4)
12	I do my exercises because I enjoy them	23 (8.4)	238 (87.2)	12 (4.4)
13	I stop doing my exercises when my pain is worse	31 (11.4)	239 (87.6)	3 (1.1)
14	I forget to do my exercises	81 (29.7)	76 (27.8)	116 (42.5)
15	I continue doing my exercises when my pain is better	11 (4.0)	244 (89.4)	18 (6.6)

As shown in Table 8, most of the participants indicated that they sometimes do their exercises as often as recommended (63.7%) and 33.0% always do their exercises as often as

recommended. Also, almost all of the participants (91.2%) indicated that they sometimes adjust the way they do exercises to suit themselves; 4.0% never did whereas 4.8% always adjust the way they do their exercises.

In terms of having time to do exercises, 16.9% indicated they always don't have time to do exercise and 68.1% were also of the view that they sometimes do have time to do exercises. Additionally, 75.5% also indicated that they sometimes do less of the exercise than recommended by their health care professional; 17.2% always do less whilst only 7.2% never do less. Lastly, 42.5% always forgets to do their exercise whilst 29.7% never forgot to do their exercises.

4.5.1 Adherence to physical exercise requirement and associated factors among participants

The result showed that only 22.0% were adherent to physical exercise recommendations whereas the majority of 78.0% achieved low adherence. In the interest of this study, 78% of non-adherence was recorded. Test of association was further performed to determine the socio-demographic factors, clinical and personal style factors associated with non-adherence to physical exercise requirement among T2D patients.

Table 9 shows the results on socio-demographic factors and non-adherence to exercise requirements.

Table 9: Background characteristics and non-adherence to exercise requirements

Variables	Adherence to exercise requirement		P-value
	No (N=213)	Yes (N=60)	
Age group			
Below 30	35 (16.44)	4 (6.67)	0.012*
30-40	43 (20.18)	23 (38.33)	
41-50	51 (23.94)	16 (26.67)	
Above 50	84 (39.44)	17 (28.33)	
Sex			
Female	100 (46.95)	24 (40.00)	0.380
Male	113 (53.05)	36 (60.00)	
Marital Status			
Married	104 (48.83)	51 (85.00)	<0.001*
Single	28 (13.14)	5 (8.33)	
Divorced/Separated/Widowed	81 (38.03)	4 (6.67)	
Education status			
No formal	20 (9.39)	0 (0.0)	<0.001*
Basic/Primary/JSS	66 (30.98)	32 (36.67)	
Vocational/Tech	84 (39.44)	4 (6.67)	
Secondary/ High school	30 (14.08)	2 (3.33)	
Tertiary	13 (6.11)	21 (35.00)	
Socio-economic status			
Poor	124 (58.22)	37 (61.67)	0.631
Rich	89 (41.78)	23 (38.33)	
Place of residence			
Rural	3 (1.41)	1 (1.67)	<0.632
Urban	210 (98.59)	59 (98.33)	
Employment status			
Working	119 (55.87)	57 (95.00)	<0.001
Not working	94 (44.13)	3 (5.00)	
Ethnicity			
Akan	28 (13.14)	50 (83.33)	<0.001
Ga/Adangbe/Krobo	35 (16.43)	6 (10.00)	
Ewe	17 (7.98)	2 (3.33)	
Hausa	77 (36.15)	2 (3.33)	
Others	56 (26.29)	0 (0.0)	
Religion			
Christian	134 (62.91)	56 (93.33)	<0.001*
Muslim	79 (37.09)	4 (6.67)	
Monthly Income			
Below 500 Ghc	132 (61.97)	35 (58.33)	<0.001*
500-999 Ghc	39 (18.31)	4 (6.67)	
1000-1499 Ghc	19 (8.92)	8 (13.33)	
1500 and above	6 (2.82)	13 (21.67)	
No income	17 (7.98)	0 (0.0)	

Note: *Measured associated is significant;

Table 10 shows the results on clinical and personal lifestyle factors and non-adherence to exercise requirements.

Table 10: test of association of clinical/personal lifestyle factors and adherence

Variables	Adherence to exercise requirement		P-value
	No (N=213)	Yes (N=60)	
Duration of disease			
2 years and below	38 (17.84)	25 (41.67)	<0.001*
3-5 years	42 (19.72)	2 (3.33)	
Above 5 years	133 (62.44)	32 (53.33)	
Family history of diabetes			
Yes	129 (60.56)	44 (73.33)	0.095*
No	84 (39.44)	16 (26.67)	
Regular blood glucose check-up			
Yes	208 (97.65)	55 (91.67)	0.045*
No	5 (2.35)	5 (8.33)	
First knowledge of diabetes			
Before coming to clinic	17 (7.98)	13 (21.67)	0.005*
During routine medical checkup	196 (92.02)	47 (78.33)	
Type of treatment			
Drug only	200 (93.90)	43 (71.67)	<0.001*
Drug and insulin	11 (5.16)	5 (8.33)	
Drug and diet therapy	2 (0.94)	12 (20.00)	
Smoking			
Yes	9 (4.22)	2 (3.33)	0.551
No	204 (95.78)	58 (96.67)	
Consume alcohol			
Yes	12 (92.9)	1 (1.67)	0.317
No	200 (77.2)	59 (98.33)	
On herbs therapy			
Yes	55 (98.2)	1 (1.67)	<0.001*
No	158 (72.8)	59 (98.33)	
Knowledge level			
Poor	86 (40.37)	1 (1.67)	<0.001*
Good	127 (59.63)	59 (98.33)	

Note: *Measured associated is significant;

4.5.2 Logistic regression analysis of factors significantly associated with non-adherence to physical exercises requirement

A binary logistic regression model was fitted to demonstrate the odds of association of factors with adherence to physical exercise.

Table 11: Multivariable analysis of factors associated with adherence to physical exercise

Variables		P-value	COR (95%CI)	P-Value	AOR (95% CI)
Age group	Below 30		1		1
	30-40	0.0056*	4.68 (1.41-15.58)	0.850	1.27 (0.11-14.67)
	41-50	0.0853	2.75 (0.83-9.11)	0.683	0.61 (0.06-6.32)
	Above 50	0.3304	1.77 (0.55-5.69)	0.459	0.44 (0.049-3.89)
Marital Status	Married		1		1
	Single	0.0435	0.36 (0.13-1.01)	0.884	0.71 (0.01-71.17)
	Divorced/Separated	<0.001*	0.10 (0.03-0.31)	0.706	0.50 (0.01-18.53)
Education status	Basic/Primary/JSS		1		1
	Vocational/Tech	<0.001	0.13 (0.04-0.40)	<0.001*	0.06 (0.01-0.36)
	Secondary/ High school	0.0306	0.27 (0.07-0.97)	0.004*	0.01 (0.00-0.14)
	Tertiary	0.0002	4.34 (1.87-10.09)	0.175	0.22 (0.02-1.96)
Employment status	Not working		1		1
	Working	<0.001*	15.00(4.22-53.40)	0.258	2.96(0.57-15.37)
Religion	Christianity		1		1
	Islam	<0.001*	0.12 (0.04-0.36)	<0.001*	0.01 (0.001-0.10)
Duration of disease	2 years and below		1		1
	3-5 years	0.0016*	0.37 (0.19-0.70)	0.479	1.95 (0.31-12.38)
	Above 5 years	0.0001*	0.11 (0.03-0.43)	0.712	2.98 (0.10-88.85)
First knowledge of diabetes	During routine checkup		1		1
	Before coming to clinic	0.0028*	3.19 (1.43-7.13)	0.11	3.69 (0.56-24.32)
Type of treatment	Drug only		1		1
	Drug and insulin	1.774	2.11 (0.69-6.44)	0.091	1.65 (0.83-3.30)
	Drug and diet therapy	<0.001*	27.90 (5.32-43)	0.242	6.21 (0.71-54.25)
On herbs therapy	No		1		1
	Yes	<0.001	0.05 (0.01-0.39)	0.141	3.38 (0.15-76.16)
Knowledge level	Poor		1		1
	Good	<0.001	29.95(4.75-35.85)	0.016*	38.80 (3.01-49.25)

Note: *Measured associated is significant; COR-Crude Odds Ratio; AOR-Adjusted Odds

Ratio; CI: Confidence Interval.

4.5.3 Adherence to dietary requirement and associated factors among participants

The result showed that only 26.7% were adherent to dietary requirement whereas the majority of 73.3% achieved low adherence. From the table, participant's sex, marital status, educational level, ethnicity and religion were found to be associated to adherence to dietary requirements.

Table 12: Background characteristics and adherence to dietary requirements

Variables	Adherence to dietary requirement		P-value
	No (N=200)	Yes (N=73)	
Age group			
Below 30	35 (17.59)	10 (13.51)	0.703
30-40	47 (23.62)	19 (25.68)	
41-50	46 (23.12)	21 (28.38)	
Above 50	71 (35.68)	24 (32.43)	
Sex			
Female	115 (58.38)	14 (19.18)	<0.001*
Male	82 (41.62)	59 (80.82)	
Marital Status			
Married	142 (71.72)	18 (24.66)	<0.001*
Single	26 (13.13)	6 (8.22)	
Divorced/Separated	3 (1.52)	8 (10.96)	
Widowed	27 (13.64)	41 (56.16)	
Education status			
No formal	15(7.54)	3 (4.05)	<0.001*
Basic/Primary/JSS	51(25.63)	41 (55.41)	
Vocational/Tech	87(43.72)	16 (21.62)	
Secondary/ High school	25(12.56)	5 (6.76)	
Tertiary	21 (10.55)	9 (12.16)	
Socio-economic status			
Poor	114 (57.29)	47 (63.51)	0.352
Rich	85 (42.71)	27 (36.49)	
Place of residence			
Rural	12 (6.03)	1 (1.35)	0.197
Urban	187 (93.97)	73 (98.65)	
Ethnicity			
Akan	69 (34.67)	15 (20.27)	<0.001*
Ga/Adangbe/Krobo	32 (16.08)	7 (9.46)	
Ewe	16 (8.04)	4 (5.41)	
Hausa	31 (15.58)	44 (59.46)	
Others	51 (25.63)	4 (5.41)	
Religion			
Christian	170 (85.43)	30 (40.54)	<0.001*
Muslim	29 (14.57)	44 (59.46)	
Monthly Income			
Below 500 Ghc	114 (61.29)	47 (66.20)	0.160
500-999 Ghc	45 (24.19)	9 (12.68)	
1000-1499 Ghc	15 (8.06)	7 (9.86)	
1500 and above	12 (6.45)	8 (11.27)	

Table 13: Association between clinical factors and adherence to dietary recommendations

Variables	Adherence to dietary requirement		P-value
	No (N=200)	Yes (N=73)	
Duration of disease			
2 years and below	41 (20.60)	12 (16.22)	0.212
3-5 years	139 (69.85)	59 (79.73)	
Above 5 years	19 (9.55)	3 (4.05)	
Family history of diabetes			
Yes	156 (79.59)	16 (21.92)	<0.001*
No	40 (20.41)	57 (78.08)	
Regular blood glucose check-up			
Yes	191 (96.95)	71 (97.26)	0.827
No	6 (3.05)	2 (2.74)	
First knowledge of diabetes			
Before coming to clinic	17 (8.63)	12 (16.22)	0.168
During routine medical checkup	180 (91.37)	62 (83.78)	
Type of treatment			
Drug only	182 (91.92)	60 (81.08)	0.002
Insulin only	2 (1.01)	1 (1.35)	
Drug and insulin	10 (5.05)	3 (4.05)	
Drug and diet therapy	4 (2.02)	10 (13.51)	
Smoking			
Yes	2 (1.01)	9 (12.16)	<0.001*
No	196 (98.99)	65 (87.84)	
Consume alcohol			
Yes	10 (5.05)	3 (4.05)	0.732
No	188 (94.95)	71 (95.95)	
On herbs therapy			
Yes	2 (1.01)	54 (72.97)	<0.001*
No	196 (98.99)	20 (27.03)	

Similarly, testing for the association between clinical factors and adherence to dietary recommendations, participants with a family history of diabetes, those who smoke and those on herbs therapy were also associated with adherence to exercise recommendations.

A multivariable analysis was done to test for the strength of the association with the significant variables. It was revealed that types of treatment; insulin only (AOR=44.0, 95%CI= 1.65 – 1171), drug and diet therapy (AOR=55.3, 95%CI= 5.59 – 547.6) and on herbs; No (AOR=0.002 95%CI=0.00 – 00.05) were associated with adherence to dietary recommendations.

Table 14: Logistic regression of factors associated with adherence to dietary recommendations

Variables		P-value	COR (95%CI)	P-Value	AOR (95% CI)
Sex	Female		1		1
	Male	<0.001	5.91 (3.09 – 11.30)	0.114	3.61 (0.74 – 17.72)
Marital Status	Married		1		1
	Single	0.247	1.82 (0.66 – 5.02)	0.971	0.96 (0.10 – 8.85)
	Divorced/Separate	<0.001	21.04 (5.11 - 86.57)	0.632	2.74 (0.04 – 169.9)
	d	<0.001	11.98 (6.01 – 23.89)	0.267	2.55 (0.49 – 13.37)
Educational status	Widowed		1		1
	No formal		1		1
	Basic/Primary/JSS	0.037	4.02 (1.09 – 14.84)	0.511	2.41 (0.18 – 33.09)
	Vocational/Tech	0.903	0.92 (0.24 – 3.54)	0.988	1.02 (0.06 – 16.15)
	Secondary/ High	1.000	1.00 (0.21 – 4.80)	0.972	1.05 (0.06 – 18.37)
Tertiary	2.142	2.14 (0.50 – 9.27)	0.785	1.53 (0.71 – 32.94)	
Ethnicity	Akan		1		1
	Ga/Adangbe/Krobo	0.990	1.01 (0.37 – 2.71)	0.875	0.86 (0.13 – 5.86)
	o	0.824	1.15 (0.34 – 3.93)	0.286	3.06 (0.39 – 23.85)
	Ewe	<0.001	6.53 (3.17 – 13.46)	0.762	0.74 (0.10 – 5.37)
	Hausa	0.085	0.36 (0.11 – 1.15)	0.676	0.60 (0.06 – 6.49)
Others		1		1	
Religion	Christian		1		1
	Muslim	<0.001	8.60 (4.68 – 15.80)	0.141	2.97 (0.70 – 12.70)
Family history of diabetes	Yes		1		1
	No	<0.001	13.89 (7.22 – 26.72)	0.833	0.78 (0.08 – 8.00)
Type of treatment	Drug only		1		1
	Insulin only	0.736	1.52 (0.14 – 17.02)	0.024	44.0 (1.65 – 1171)
	Drug and insulin	0.889	0.91 (0.24 – 3.42)	0.094	7.32 (0.71 – 75.50)
	Drug and diet	0.001	7.58 (2.29 – 25.07)	0.001	55.3 (5.59 – 547.6)
	therapy		1		1
Smoking	Yes		1		1
	No	0.001	0.07 (0.02 – 0.35)	0.332	4.68 (0.21 – 105.39)
On herbs therapy	Yes		1		1
	No	<0.001	.004 (0.001 – 110.7)	<0.001	0.002 (0.00 – 00.05)

Note: *Measured associated is significant; COR-Crude Odds Ratio; AOR-Adjusted Odds Ratio

4.6 Adherence to dietary requirement among type 2 diabetes patients

The final part of the study looked at the level of adherence to dietary requirement among T2D patients. The results are presented in table and charts where frequencies and percentages are provided.

Table 15 shows the general eating behavior among participants.

Table 15: Eating behavior among participants

Variables	Frequency	Percentage
Number of meals usually eaten during the day		
1 meal	3	1.1
2 meals	8	2.9
3 meals	262	96.0
Usually eat meals at the same times		
Yes	130	47.6
No	146	52.4
The most frequent time intervals between meals		
2 hours	16	5.9
3-4 hours	188	68.9
5-6 hours	69	25.3
Eat snacks in between your meals during the day		
Yes	32	11.7
No	210	76.9
Sometimes	31	11.4

4.6.1 Dietary/food frequency patterns among participants

Participants were examined to determine their eating patterns and frequency across the various food groups.

The results are presented in table 16 and Figure 5

Table 16: Fish/meat and starch/carbohydrate food frequency

Food frequency		Never	Sometimes (1-3x a month)	Always (≥ 4x a month)
Fish/meat/seafood	Beef meat	39 (14.3)	229 (82.8)	8 (2.9)
	Goat meat	83 (30.40)	7 (2.6)	7 (2.6)
	Pork	202 (74.0)	63 (23.1)	8 (2.9)
	Chicken	33 (12.1)	172 (63.0)	68 (24.9)
	Game (bushmeat)	39 (14.3)	223 (81.7)	11 (4.0)
	Fish (tuna , mackerel, tilapia, cassava fish, etc)	6 (2.2)	183 (67.0)	84 (30.8)
	Eggs	13 (4.8)	200 (73.3)	60 (22.0)
	Seafood (shrimps, oyster, crab, snails, etc)	16 (5.9)	241 (88.3)	16 (5.9)
Starches	Rice	2 (0.7)	197 (72.2)	74 (27.1)
	Rice and beans	3 (1.1)	187 (68.5)	83 (30.4)
	Banku/ kenkey	6 (2.2)	186 (68.1)	81 (29.7)
	Fufu/ kokonte	6 (2.2)	188 (68.9)	79 (28.9)
	Yam/plantain/cocoyam/potato	2 (0.7)	201 (73.6)	70 (25.6)
	Spaghetti/macaroni/noodles	189 (69.2)	83 (30.4)	1 (0.4)

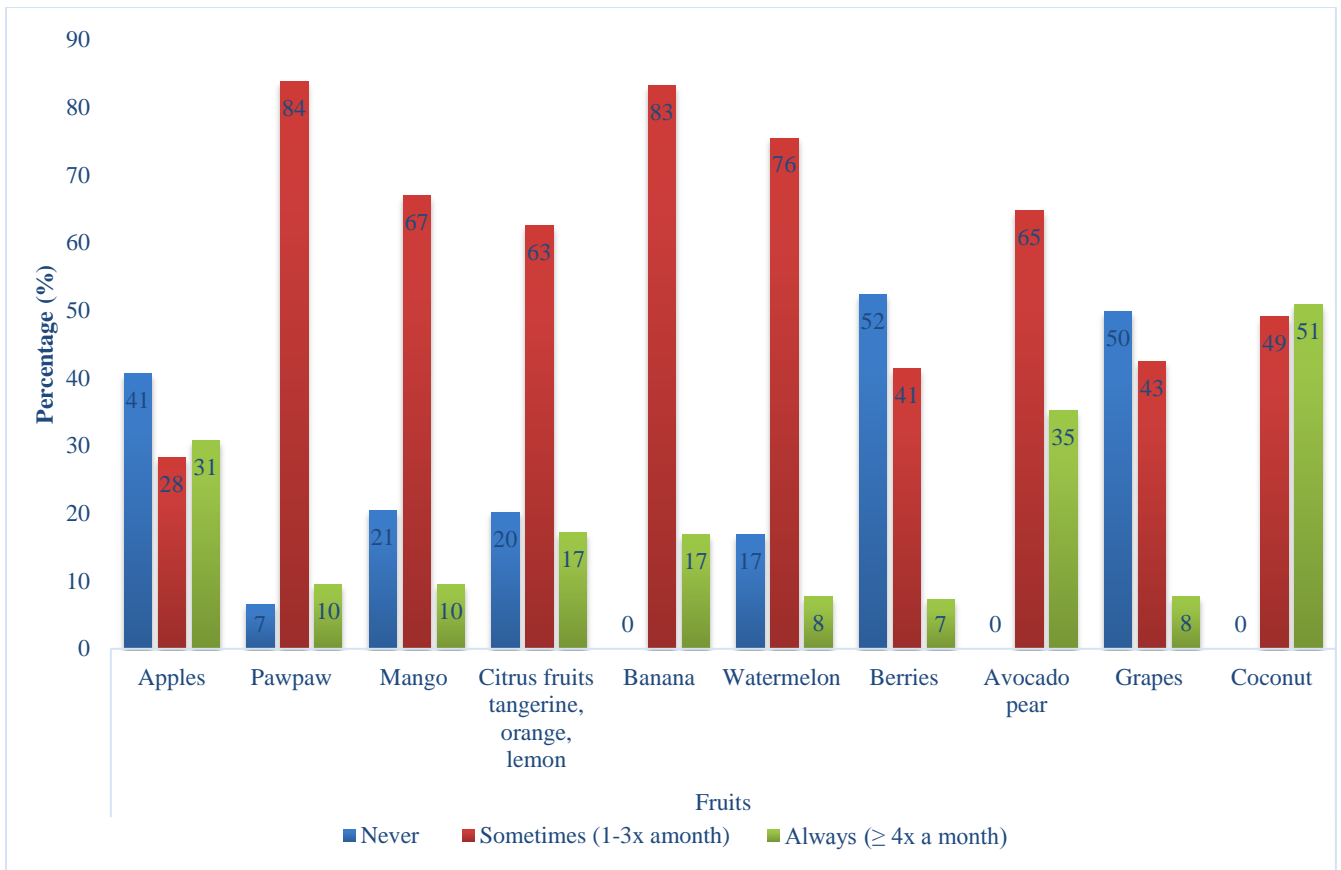


Figure 5: Fruit frequency patterns among participants

CHAPTER FIVE

DISCUSSION

5.1 Introduction

This chapter discusses the results presented in the previous chapter. The discussion consists of the summary of the findings and comparison of the findings from the study with previous studies. Also, the chapter deals with the implications of the study as well as strengths and limitations of the study. The purpose of this study was to determine whether low Socio-economic status of the participants influenced their adherence to dietary and physical exercise recommendations. In addition, the research is to assess the level of knowledge and associated factors on the role of dietary and exercise requirements in the management of T2D patients, to identify the level of non-adherence to physical exercise among T2D patients, to assess the socio-demographics and clinical predictors of non-adherence to physical exercise among T2D patients and lastly to identify the level of non-adherence to diet among T2D patients.

5.2 Prevalence of participants who adhere to physical exercise recommendations

From the results, approximately 22.0% of the patients reported to adhere to physical exercise whereas majority, 78.0% do not adhere to physical exercise. In addition, patients showed good knowledge on the role of physical exercise and diet in the improvement of T2D. About 76.9% indicated in agreement that adhering to exercise recommendations could improve one's diabetic condition. In addition to the above, patients indicated their level of non-adherence to exercise. About 63.7% of the patients said that they sometimes do exercise and 33.0% of the patients always do their exercises as often as recommended. More so, 68.1% of the participants said they sometimes do have time to do exercise, however, 16.9% of the participants said they always don't have time to do exercise.

5.3 Factors that influence adherence to physical exercise recommendations

The primary hypothesis of this study was to assess the influence of Socio-economic status of patients on their adherence to physical exercise recommendations. From the findings of this study, Socio-economic status of the participants did not influence their adherence to physical exercise recommendations. To determine the factors that would influence patient's adherence to physical exercise, the study found that participants who had vocational education had a 99% reduced odds of adhering to physical exercise recommendations compared to participants with basic education.

The study found that participants who had 'good knowledge' were 38 times more likely to adhere with physical exercise recommendations compared to participants with low knowledge. Where persons are educated and well informed on the management of their conditions, they are well placed to adhere to recommended plans of management. This finding is consistent with Lascar et al where the study established that education to improve on patient knowledge improves on adherence to physical exercise. In this study he observed that educating participants on the need to exercise and the impact of exercise at reducing the glycemic levels in blood, goes a long way to improve participants adherence to physical exercise

It is hypothesized that a higher training frequency (at least 3 days/week) may be necessary to maintain its effects on daily glucose control. For this reason, it seems plausible to recommend that exercise should be performed on most days of the week. However, it is also essential to consider the higher risk of overtraining or injury in the habitually sedentary T2DM patients. These concerns can be addressed by careful exercise planning that adequately alternates intensity, duration and mode of exertion on different training sessions.

5.4 Level of patient's knowledge on importance of physical exercise and diet recommendations

From this study, the proportion of participants that are knowledgeable on the importance of diet and physical exercise recommendation for the management of diabetes was 67.8%. That indicates that 185 of the total respondents had sufficient knowledge on the importance of diet and physical exercise recommendation for the management of diabetes. This is inconsistent with a study by Sami et al (2017) where he realised that there was low level of knowledge on the importance of diet and physical exercise recommendation for the management of diabetes. This finding of high level of knowledge amongst diabetic patients at the Tema General Hospital is attributed to the frequent education they receive at the hospital during the diabetic clinic days. This has made them more knowledgeable. Knowledge is a requirement to achieve better adherence with lifestyle modification therapy. Where participants have come to appreciate the importance of engaging in exercise and dietary modifications to help regulate hyperglycemia, they may not complain of the processes as been rigorous.

5.5 Factors that influenced knowledge on importance of physical exercise and diet recommendations

This sought to identify factors that may influence the knowledge of participants on the importance of physical exercise and dietary recommendations. From the study, it was realised that males were 4.3 times more likely to be knowledgeable compared to females. It is seen that males tend to be more inclined to engage in physical activities to improve their health compared to females. Where they are morbid, they would seek enough knowledge about their medical conditions and ways to improve their health.

Also, ethnicity was identified to influence the level of knowledge of the participants. It was realised that Hausas less likely to be knowledgeable about the importance of physical exercise and dietary recommendations in the management of diabetes conditions. There was about 97% reduced chance that Hausas would be knowledgeable on the importance of

physical exercise compared to the Akans. Thus, more education should go to the Hausas to improve on adherence to physical exercise and diet modification.

5.6 Prevalence of participants who adhere to physical exercise recommendations

The prevalence of participants who adhered to dietary recommendations was 26.7%. This findings indicates that a lower proportion of the participants adhere to dietary recommendations presented to them by their dietician. This finding is very worrying considering the fact that diabetes can be best managed with a combination of drugs and lifestyle modifications especially dietary modifications. Due to the risk of nephrotoxicity, diabetics are advised by dieticians to reduce their protein intake

5.7 Factors that influence adherence to dietary recommendations

The findings of this study did not support the primary hypothesis. Results indicate that the Socio-economic status of the participants did not influence their adherence to dietary recommendations. The study also established that participants who are on insulin only were 44 times more likely to adhere to dietary recommendations compared to participants who were on drugs only. This is because most often for T2D patients, they are placed on insulin when it is quite challenging to achieve adequate glycemic control. Most often the diabetic condition may be worse. Such participants are willing to adhere to medical advice to help manage their conditions. Also participants who were on drug and dietary therapy were 55times more likely to adhere to dietary recommendations compared to participants who are on drugs only.

5.8 Eating behaviour among participants

The eating behaviour of diabetic patients is of great importance to the management of hyperglycemia. Constantly diabetics are advised to maintain three meals daily since the drugs given them is to reduce the blood sugar. Once there is a reduced number of times meals are

taken, there is an increased risk of hypoglycemia. From this study, 96% of the respondents took 3 meals a day. This proportion was very encouraging, as majority of participants were not skipping meals in order to control their blood sugar.

Regularization of eating time helps with digestion and proper planning of frequency for drug administration. Most diabetic drugs are administered either pre-prandial or post-prandial. Most diabetics are advised to eat at scheduled times so as to help with glucose metabolism. This study established that 52% of the respondents ate on time and this is very encouraging. However, more patients should be encouraged to regularize their eating times. This would go a long way to help with glycaemic control

Patients with T2D are advised to eat adequate amounts of food required for daily activities. They are also advised to have snacks in between meals when there is symptom of hypoglycemia. This is because they are often more susceptible to reduced blood sugar after drug administration. However, barring incidence of hypoglycemia which may require eating snacks in between meals, diabetics are required not to eat snacks in between meals as it could increase their blood glucose level. Majority of participants, that is 76%, responded that they do not eat snacks in between meals. Overall, the eating behaviour of participants was encouraging.

Diabetics are advised to reduce their protein intake due to the potential of increasing the risk of kidney failure. Sadly, most of them may resort to avoiding protein intake completely. This situation may be harmful to their health. Since protein is essential for growth and cell formation, a stop in its intake may trigger the body to utilize protein from human muscle. Metabolism of the human muscle leads to production of more nitrogenous waste that may be even more nephrotoxic, hence rapid deterioration of the patient's kidney. From table 4.10, it

was observed that majority of the participants take proteins in moderation. This would go a long way to prevent damage to the kidneys

Dietitians advise patients with diabetes to increase their intake of fruits especially those with less glycemic index such as avocado pear, watermelon etc. Studies have found out that most of these fruits contain antioxidants which increase the secretion of insulin to help with glucose regulation. From figure 4.3, most participants sometimes take fruits. The study observed that majority of the participants do not take fruits especially the berries, apples that have been known to manage oxidative stress in diabetics. While dieticians recommend intake of fruits, it is noted that frequent intake of fruits with high glycemic index such as pineapple, banana may add on to the blood glucose of patients with diabetes and this may worsen their condition.

5.9 Consistency with Previous Research

Diabetes as a condition has been identified to have no permanent cure. However, combinations of pharmacotherapy and non-pharmacotherapy such as dietary changes and lifestyle modifications have proven to control and manage the condition so it does not get worse.

From the current study, participants revealed that physical exercise and diet adherence could help to control and manage diabetes. This is almost in line with studies done in Yemen, Hodeidah city. In that study, about 21.0% and 15.0% complied with diet and regular exercise respectively in managing diabetes. Similar studies in Jordan and Kuwait by Shokair N.F (2007), revealed similar results. Participants indicated that, diet and physical exercise recommended, could help in managing diabetes.

Furthermore, it was revealed in this study that, socio-demographics: education and religion were the only factors associated with adherence to physical exercise. For example,

participants who had secondary/technical education were 99% reduced odds to adhere with physical exercise compared to those who have had basic or primary education. This was not consistent with other studies. Mumu et al, 2015 and Alrahbi, 2014 which revealed otherwise. In their study they found that age distribution of the patients significantly influenced adherence to physical exercise. Another study in Saudi Arabia also found the use of insulin to be significantly associated with diet that contradicts the current study.

One reported solution to the non-adherence of an exercise recommendation could be improved empowerment of patients regarding their care. In so much as patient self-efficacy (self-reliance) results in improved adherence to provider recommendations, it seems crucial that health care providers promote a “take responsibility for your diabetes care” mind-set in their patients and formulate an alliance with their patients in their care.

5.10 Strengths and Limitations of the Study

This study helped to identify the overall adherence among patients regarding dietary and exercise requirements in the Tema General Hospital in the Greater Accra region of Ghana. The study like most researches is not without limitation. Some participants might have also given false information about themselves to look good. Also, where participants are to recall events of the past, the responses may have been biased. This led to recall bias.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

The chapter gives the conclusions as well as the recommendations.

6.1 CONCLUSIONS

The study set out to provide essential empirical data on adherence to diet and exercise regimen among patients with type 2 diabetes, and to test the hypothesis that patients with low SES are at an increased odds of poor adherence at the Tema General Hospital. To achieve this objective, an institutionally based cross-sectional study was conducted among 275 participants.

The results from the current study showed that, a lower proportion, that is 22%, of diabetic patients adhere with physical exercise recommendations. However, factors such as educational status and religion of participants were found to influence the chance to adhere with physical exercise recommendations. Vocational trainee had about 99%-reduced odds to adhere with physical exercise recommendations compared to participants with Basic Education.

Assessing the proportion of respondents who had sufficient knowledge on the importance of physical exercise and dietary recommendations, this study realized that, 67.8% of the respondents were knowledgeable on the benefits of physical exercise and dietary recommendations in the management of diabetes. Factors that were found to influence the knowledge were gender and ethnicity. The study established that males had 4.3 times increased odds to be knowledgeable on the benefits of exercise and dietary recommendations compared to females. In addition, Hausas were found less likely to be knowledgeable on the benefits associated with physical exercise and dietary modifications in diabetes management.

The prevalence of participants who adhered to dietary recommendations was 26.7%. The study also established that participants who are on insulin only were 44times more likely to adhere to dietary recommendations compared to participants who were on drugs only. Also [participants who were on drug and dietary therapy were 55times more likely to adhere to dietary recommendations compared to participants who are on drugs only.

On participants' dietary habits and patterns, this study found that majority of diabetics, that is 96%, had the recommended 3 square meal a day. 52% of these persons had regularized eating times to ensure proper glycemic control in the body. However, most participants did not consume fruits.

In conclusion, adherence to diet and exercise was found to differ for each person and it is a combination of several factors. However, it was strongly influenced by the individual's views, current circumstance and what they deemed right for themselves.

6.2 RECOMMENDATIONS

From the findings gathered from the current study the following recommendations have been drawn.

For research

Given the limitations of a cross-sectional design this study is only able to generate important hypotheses about factors that could be associated with poor adherence to exercise and dietary regimens among T2D patients; future efforts should employ more rigorous study designs such as prospective cohort or case-control studies to help establish causality. In addition, future studies should be conducted to ascertain the impact of physical exercise and dietary modifications on the long-term management of diabetes.

For public health

For public health impact there should be an increased awareness campaign to sensitize the public especially patients with diabetes on the need for lifestyle modifications to help reduce the risk of developing diabetes.

For policy

Pending the completion of studies that use improved study designs, the study has produced some useful data that could potentially influence policy direction regarding management of diabetic patients in Tema. For example, based on the relatively low prevalence of adherence recorded in this study, a diabetes policy could be formulated to ensure that in the management of diabetic patients there is an integration of physical exercise and dietary modifications to ensure adequate management. There could be an inclusion of a diet card and exercise monitoring card to enhance adherence.

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APPENDIX A: QUESTIONNAIRE

ADHERENCE TO DIET AND EXERCISE REGIMEN AMONG PATIENTS WITH TYPE 2 DIABETES

My name is **GRACE DZIFA WORNIOH**, a student of the School of Public Health, University of Ghana. I am conducting a research on adherence to diet and exercise regimen among patients with Type 2 diabetes. This forms part of the requirement for the award of a Master of Public Health degree. If you agree to be a part of this study, I would ask you a few questions which require answers. Your participation is voluntary and you are free to end the interview at any time. But I would be very grateful if you participated in the study to contribute to existing knowledge on Type 2 diabetes.

Form No......

Date/...../.....

Section 1: Demographic characteristics

(Kindly check the appropriate box that corresponds to your answer. Provide response where options are not given)

No.	Characteristics	Category	Code
1	Age (in years)	
2	Height (mm)		
3	Weight (kg)		
4	Duration of diabetes	1. 1-2 [] 2. 3-5 [] 3. 6-9 [] 4. 10 and above []	
5	Sex	1. Female [] 2. Male []	
6	Marital status	1. Married [] 2. Single [] 3. Divorced/Separated [] 4. Widowed []	
7	Education	1. No formal [] 2. Basic/Primary/JSS [] 3. Vocational/Tech [] 4. Secondary/ High school [] 5. Tertiary []	
8	Place of residence	1. Rural area []	

		2. Ural area []
9	Employment status	1. Public sector work [] 2. Private employee [] 3. Self-employed [] 4. Unemployed [] 5. Student [] 6. 6 Retired []
1	Ethnicity	1. Akan [] 2. Ga/Adangbe [] 3. Krobo [] 4. Ewe [] 5. Hausa [] 6. Others, specify.....
0		
11	Estimated monthly income	1. Below 500 Ghc [] 2. 500-999 Ghc [] 3. 1000-1499 Ghc [] 4. 1500 and above []

Section 2: Medical history of the respondents

No.	Variables	Categories	Code
1	Family history of diabetes	1. Yes [] 2. No []	
2	Other diseases apart from diabetes	1. Hypertension [] 2. Heart failure [] 3. Kidney problem [] 4. Visual problem [] 5. Leg ulcer []	
3	Duration of illness	1. <1yrs [] 2. 1-5 yrs [] 3. 6-10 yrs [] 4. Above 10 yrs []	
4	Glycemic control: HbA1c	
5	Regular blood glucose check-up	1. Yes [] 2. No []	

- | | | |
|----|-------------------------------|---|
| 6 | First knowledge of diabetes | 1. Before coming to clinic []
2. During routing medical []
3. checkup During treatment of a disease [] |
| 7 | Type of treatment | 1. Drug only []
2. Drug and diet therapy [] |
| 7 | Smoking | 1. Yes []
2. No [] |
| 8 | Consume alcohol | 1. Yes []
2. No [] |
| 9 | Follow diet without treatment | 1. Yes []
2. No [] |
| 10 | On tablets | 1. Yes []
2. No [] |
| 11 | On insulin | 1. Yes []
2. No [] |
| 12 | On herbs therapy | 1. Yes []
2. No [] |

Section 3: Physical activities adherence

No.	Items	Never	Sometimes	Always
1	I do my exercises as often as recommended			
2	I adjust the way I do my exercises to suit myself			
3	I don't get around to doing my exercises			
4	Other commitments prevent me from doing my exercises			
5	I feel confident about doing my exercises			

- 6 I don't have time to do my exercises
- 7 I'm not sure how to do my exercises
- 8 I do some, but not all, of my exercises
- 9 I don't do my exercises when I am tired
- 10 I do less exercise than recommended by my healthcare professional
- 11 I fit my exercises into my regular routine
- 12 I do my exercises because I enjoy them
- 13 I stop doing my exercises when my pain is worse
- 14 I forget to do my exercises
- 15 I continue doing my exercises when my pain is better

Section 4: Dietary Adherence

Instructions: please complete the following questions to reflect your opinions as accurately as possible and to answer factual questions to the best of your knowledge.

Please select only one answer for each question.

1	How many meals do you usually eat during the day?	1. 1-2 meal [] 2. 3-4 meals [] 3. 5-6 meals [] 4. Above 6meals []	
2	Do you usually eat meals at the same times?	1. Yes [] 2. No []	
3	What are the most frequent time intervals between meals?	1. 3 hours [] 2. 5-6 hours [] 3. 3-4 hours [] 4. 6 hours []	
4	Do you add sugar to hot drinks, such as tea, cocoa, or coffee?	1. Yes [] 2. No []	
5	What kind of bread do you usually eat?	1. Rye bread, whole grain [] 2. White bread, Vienna roll [] 3. I do not eat bread []	

Dietary Adherence: Food frequency questionnaire for diabetic patients

Food frequency questionnaire		Never	Sometimes	Always
Protein	Beef meat 210g Boneless			
	Chicken 210g Boneless			
	Fish 210g			
	Eggs 50gm			
	Milk all kinds 100ml			
Grains	Rice 120g			
	Bread or loaf (wheat 120g)			
	Bread or loaf (Flour120g)			
Fruits	Apples 120g medium-sized			
	Banana 120g medium-sized			
	Orange 120g medium-sized			
	Mango 120 medium-sized gm			

Food frequency items		Never	Sometimes	Always
Vegetables	Tomato (One serving is 250g)			
	Cucumber (One serving is 250g)			
	Eggplant (One serving is 250g)			
	Onions (50 grams per meal)			
	Cabbage (One serving is 250g)			
Fat	Animal fat (fat free) spoon cup 5ml			
	Olive oil cup 5ml			
	Palm oil cup 5ml			

Section 5: knowledge on the role of diet and exercise in the management of T2D

No.	Characteristics	Category	Code
1	Conditions of diabetic patients can be improved by adhering to exercise	1. Yes 2. No 3. Don't know	
2	Skipping dietary regimen of prescribed may not help to improve condition	1. Yes 2. No 3. Don't know	
3	Eating food in large quantity that should be taken in little quantity is harmful to you	1. Yes 2. No 3. Don't know	
4	Eating foods that one should stop taking because of the disease is harmful to your condition	1. Yes 2. No 3. Don't know	
5	better general knowledge of dietary and exercise could lead to consistent modification and awareness for the patient	1. Yes 2. No 3. Don't know	

APPENDIX B: INFORMATION SHEETS

PARTICIPANT INFORMATION SHEET FOR PATIENTS WITH TYPE 2 DIABETES MELLITUS AT THE TEMA GENERAL HOSPITAL, GREATER ACCRA REGION

PROJECT TITLE: ADHERENCE TO DIET AND EXERCISE REGIMEN AMONG PATIENTS WITH TYPE 2 DIABETES AT THE TEMA GENERAL HOSPITAL, GREATER ACCRA

INTRODUCTION

I am Grace Dzifa Wornoyoh, a student of the School of Public Health, University of Ghana. Legon. I am a postgraduate Student of the University of Ghana (UG) reading Masters of Public Health (MPH). I am the principal investigator of this study.

BACKGROUND AND PURPOSE OF RESEARCH

Diabetes mellitus (DM) is one of the most common chronic diseases in both Western and developing countries. Medication is not the sole method of treating type 2 diabetes mellitus; significant changes to the patient's lifestyle with respect to dietary habits and regular physical activity are also required. In fact, lifestyle change is the most challenging and difficult part of the treatment. A study on the adherence, reasons and lifestyle modification factors in diabetes management are essential for the formulation and implementation of appropriate measures to enhance care and support for patients with diabetes. I am here with my research assistants to carry out a study to find the adherence of type 2 diabetes patients to dietary and exercise recommendation.

NATURE OF RESEARCH

You are being invited to partake in this study. I am interested in finding the adherence among patients with type 2 diabetes regarding dietary and exercise requirements in the Tema General Hospital in the Greater Accra Region of Ghana.

PARTICIPANTS' INVOLVEMENT

DURATION /WHAT IS INVOLVED

This study will involve taking your clinical information and answering questions on socio-demographic factors and treatment adherence. Should you agree to participate, about 20-30 minutes would be used to ask you some few questions relating to the study. The information you provide will add to knowledge about the treatment behaviors among patients of diabetes.

POTENTIAL RISKS

Taking part in the study would not affect the quality of care you receive in any way. This research has no risks to you apart from feeling uncomfortable about answering some questions. Any possible risk that may occur in the form of any distress will lead to the respondent's participation in the study being ended. Respondents will be given free psychosocial support where the researcher will bear the cost if the need arises.

BENEFITS

Patients who will participate in the study will have the opportunity to be educated on the importance and benefits of exercises and balance diet in the management of type 2 diabetes. Also, respondents who will need special attention in the course of the study in terms of diet or exercise management will be referred appropriately.

The results of the study will help formulate policies that will help improve and support patients living with diabetes to live healthier lives with less risk of complications at Tema General Hospital and the general public.

ADDITIONAL COSTS AND COMPENSATION

You will not have to spend money in partaking in this study and you will not be compensated for participating. If you agree to participate in the study, you will be asked to fill the questionnaires before or after your medical appointment and in a place at the hospital that is convenient for you. You will only have to spare 20-30 minutes of your time to answer the questions I will ask.

CONFIDENTIALITY

No name will be recorded. Your name and identity are not needed in the study. However, the information you are going to provide will be coded and will be treated strictly confidential. You are assured of total confidentiality to the information you will give. Apart from the researcher and supervisor of this research, no one else will have access to information provided whether in part or whole. The information that I will collect from this study will be used only for academic purposes.

VOLUNTARY PARTICIPATION/WITHDRAWAL

Participation in this study is voluntary. You are free to answer part or the entire questionnaire. You can choose to withdraw from the study or stop the interview at any time you want. You can also choose not to answer any question(s) you find uncomfortable about. No one will be coerced to obtain response from you, and you are at liberty to withdraw from the study at any time and it will not affect you in any way. Taking part in the study would not affect the quality of care you receive in any way.

OUTCOME AND FEEDBACK

Data collected will be stored under lock and key then destroyed after a minimum of three years as per research protocol. No feedback would be given to you.

FUNDING INFORMATION

This study is a self-sponsored study.

SHARING OF PARTICIPANTS INFORMATION/DATA

Data from this study solely belong to the principal investigator. Data taken from you would not be shared with anyone.

PROVISION OF INFORMATION SHEET AND CONSENT FORMS

A copy of the information sheet will be given to you after you have read, understood and

signed or thumb printed to take home.

WHO TO CONTACT FOR FURTHER CLARIFICATION/QUESTIONS

If you have any question(s) or further clarification concerning this study and/or the conduct of the researcher and research assistants, please do not hesitate to contact the following;

1. Miss Grace Dzifa Wornyoh (Principal Investigation):

Tel: 0243512963

Email: dzifawornyoh@gmail.com

Or

2. Dr Benedict Weobong (Supervisor):

Tel: 0200827195

Email: bweobong@ug.edu.gh

If you have any concerns or need clarifications regarding ethical issues, please contact

Mrs. Hannah Frimpong (Administrator)

Ghana Health Service, Ethics Review Committee Secretariat, Accra

Tel: 0507041223/0243235

APPENDIX C: CONSENT FORM

CONSENT FORM FOR PATIENTS WITH TYPE 2 DIABETES AT THE TEMA GENERAL HOSPITAL, GREATER ACCRA REGION.

PROJECT TITLE: ADHERENCE TO DIET AND EXERCISE REGIMEN AMONG PATIENTS WITH TYPE 2 DIABETES AT THE TEMA GENERAL HOSPITAL, GREATER ACCRA REGION.

PARTICIPANTS' STATEMENT

I acknowledge that I have read or have had the purpose and contents of the Participants' Information Sheet read and that all questions have been satisfactorily explained to me in a language I understand (English /Ewe /GA / TWI). I fully understand the contents and any potential implications as well as my right to change my mind (ie withdraw from the research) even after I have signed this form.

I voluntarily agree to be part of this research.

Name or Initials of Participant..... ID Code

Participants' Signature ...OR Thumb Print..... OR Mark (Please specify).....

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 (English /Ewe /GA / TWI). language to his/her proper understanding.

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

Name of Interpreter.....

Signature of Interpreter.....

Date:.....

Contact Details.....

STATEMENT OF WITNESS

I was present when the purpose and contents of the Participant Information Sheet was read and explained satisfactorily to the participant in the language he/she understood (English /Ewe /GA / TWI).

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

Name:.....

Signature..... OR Thumb Print OR Mark (please specify).....

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 have been addressed.

Researcher's name.....

Signature

Date.....

ETHICAL CLEARANCE

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

*In case of reply the
number and date of this
Letter should be quoted.*

*MyRef: GHS/RDD/ERC/Admin/App/
Your Ref. No.*



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9th July, 2019

Grace Dzifa Wornoyoh
University of Ghana
School of Public Health
Legon

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	GHS-ERC 052/04/19
Project Title	Adherence to Diet and Exercise Regimen among Patients with Type 2 Diabetes at the Tema General Hospital, Greater Accra, Ghana
Approval Date	9 th July, 2019
Expiry Date	8 th July, 2020
GHS-ERC Decision	Approved

This approval requires the following from the Principal Investigator

- Submission of yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.
- Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
DR. CYNTHIA BANNERMAN
(GHS-ERC CHAIRPERSON)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

