NUTRITION KNOWLEDGE, DIETARY PRACTICES AND NUTRITION STATUS OF PATIENTS WITH TYPE 2 DIABETES AND ATTENDING DIABETIC CLINIC AT NAKURU LEVEL 6 HOSPITAL, KENYA

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A Thesis submitted to the Institute of Postgraduate Studies in Partial Fulfillment of the Requirements for the Award of the Master of Science in Human Nutrition and Dietetics Degree

KABARAK UNIVERSITY

NOVEMBER 2022

DECLARATION

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To the Institute of Postgraduate Studies:

The research thesis entitled "**Nutrition Knowledge, Dietary Practices and Nutrition Status of Patients With Type 2 Diabetes And Attending Diabetic Clinic at Nakuru Level 6 Hospital, Kenya"** written by **Dominic Kiprotich** is presented to the Institute of Postgraduate Studies of Kabarak University. We have reviewed the research thesis and recommend it be accepted in partial fulfillment of the requirement for the award of the degree of Master of Science in Human Nutrition and Dietetics

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ACKNOWLEDGEMENT

First, I would like to thank the Almighty God for the protection, good health and protection He has given to me throughout this study. I would also like to appreciate my supervisors; Dr. Peter Chege and Dr. Dorothy Mituki for their direction and commitment throughout my studies. I could not be more thankful to all members of the Human Nutrition and Dietetics Department of Kabarak University as well as my fellow students. To all, receive my gratitude and appreciation for the unwavering support and encouragement.

DEDICATION

This study is dedicated to my beloved wife Mrs. Susan Kiprono and my parent Mrs. Evaline Lang'at. Thank you both, your support and encouragement has been immeasurable. I am deeply indebted.

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ABBREVIATIONS AND ACRONYMS

ADA	**:**	American Diabetes Association
BMI	**:**	Body Mass Index
CDC	**:**	Center for disease control and prevention
CHD	**:**	Coronary Heart Disease
DM	**:**	Diabetes Mellitus
FAO	**:**	Food and Agriculture Organization
FANTA	**:**	Food and Nutrition Technical Assistance
FBS	**:**	Fasting blood sugar
HbA1c	**:**	Glycated hemoglobin
IDF	**:**	International Diabetes Federation
NACOSTI	**:**	National Commission for Science, Technology and Innovation
NIDDM	**:**	Noninsulin-dependent diabetes mellitus
NS	**:**	Nutrition Status
RBS	**:**	Random Blood Sugar
RDA	**:**	Recommended Dietary Allowance
SPSS	**:**	Statistical packages for social sciences
SSA	**:**	Sub-Saharan Africa
T2DM	**:**	Type 2 Diabetes Mellitus
UKPDS	**:**	UK Prospective Diabetes Study
USD	**:**	United States Dollars
WHO	**:**	World Health Organization

OPERATIONAL DEFINITION OF TERMS

Diabetic patient: Refers to a person with diabetes mellitus

Dietary practice: Patients food consumption frequency, dietary diversity and adequacy

Diabetes management: Monitoring of blood glucose within normal levels by virtue of the diet consumed.

Fasting blood sugar: This measures your blood sugar after an overnight fast

Nutrition knowledge: Patient's nutrition knowledge on diabetes and its management

Nutrition status: Patients Body Mass Index and glycemic control

Type 2 Diabetes Mellitus: It is a type of Diabetes Mellitus characterized by your body's inability to effectively utilize insulin.

Recommended dietary allowance: Levels of intake of essential nutrients that are adequate to meet the known nutrient needs of individuals.

Random blood sugar levels: It is a glucose test on the blood of a non-fasting person.

Glycated hemoglobin: The A1c test is a common test that measures how much sugar has been in your blood over the previous few months.

Level 6 Hospital: Range of services offered is the same as those offered on Level 5, but they offer specialized treatments to patients and are not only accessed by Kenyans but do serve East Africa and Central Africa

ABSTRACT

The prevalence of Diabetes Mellitus (DM) is on a rising trend. This is worrying because the complications are severe. Billions of dollars are also spent in the management of DM. Cost-effective interventions are available and include dietary management. Dietary intervention is effective though still a major challenge. Against this backdrop, this study therefore set out to determine the Type 2 Diabetes Mellitus (T2DM) patients' nutrition knowledge, dietary practices and nutrition status in order to develop an effective intervention strategy. Descriptive cross-sectional design was used among 262 T2DM patients at Nakuru level 6 Hospital. Fisher's 1998 formula, was used to determine the sample size. Study participants were chosen using simple random sampling, whereas the hospital and clinic were chosen purposively. A Pretest was done at Naivasha Hospital among 10% of respondents. A semi-structured questionnaire was used, and the collected Data was analyzed using SPSS and Nutri-survey. All research and ethical approvals as well as permits were obtained from KUREC, NACOSTI, and Nakuru Level 6 Hospital. Most respondents had a normal BMI; in kg/m^2 103(39.3%), low DDS 162(61.8%), and high nutrition knowledge 230(87.8%). Respondents' income ($P \leq 0.01$), and level of education ($P \leq 0.007$) had a significant association with nutrition knowledge. Household income ($P \leq 0.018$) and BMI; in kg/m^2 ($P \leq 0.022$) had a significant association with DDS. Participant's random blood sugar levels had a significant association with the participant's carbohydrate ($P \leq 0.034$) and fiber consumption ($P \leq 0.016$). Participants BMI; in kg/m^2 also had a significant association with DDS ($P \leq 0.001$) and energy consumption ($P \leq 0.006$). Participants with no formal education were more likely to have good nutrition knowledge (AOR: 3.921). Similarly, those who earn an income of ≥20000 were more likely to have good nutrition knowledge (AOR: 1.274). Finally, participants who were younger <45 years were more likely to have a good glycemic control (AOR: 1.319).The patients' level of education and income affects their nutrition knowledge, in that participants with higher level of education and those with more income had a higher level of nutrition knowledge. Household income and BMI; in kg/m^2 affected T2DM patients' dietary diversity in that having a high dietary diversity leads to good nutrition status. Emphasis therefore needs to be placed on proper dietary practices. Further research should be considered on determining the effect of income, education and BMI; in kg/m^2 on both nutrition knowledge and dietary diversity on the predictors of T2DM such as gender, age and income

Key words: Type 2 diabetes mellitus, nutrition knowledge, dietary practice, diabetes, knowledge, Nutrition status, glycemic control

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter discussed the background of the study, statement of the problem, purpose, objectives, and research questions. In addition, justification, scope, limitations, and assumptions of the study were also discussed.

1.2 Background of the study

Diabetes Mellitus (DM) is a disorder characterized by the body's inability to produce any or enough insulin in response to elevated blood glucose levels (DeFronzo et al., 2015). DM is classified into three: type 1, type 2 and gestational diabetes. Type 1 and gestational diabetes accounting for approximately 10% of the cases, whereas, T2DM accounts for close to 90% of all the DM cases (Stumvoll, Goldstein & Haeften, 2005). Global prevalence of T2DM is propelled by a rising number of aging population, increased economic development and urbanization which results in sedentary lifestyle and consumption of unhealthy diet (Basu et al., 2013).

Globally, T2DM cases are on the rise and is quickly becoming a major public health issue (Khan et al., 2019). Global statistics puts the prevalence of diabetes at 425 million, with a projection of a 48% rise in diabetic cases by the year 2045 to 629 million. Countries in the African continent have seen a significant increase in prevalence of up to 16 million, with an expected rise in prevalence to 41 million by 2045. Whereas, in Kenya's the prevalence is estimated at 458,900 people which is 2.0% of the diagnosed

diabetic cases (International Diabetes Federation {IDF}, 2017). Nakuru, one of the most populous Counties in Kenya has a diabetes prevalence of 6.6%, which is higher than that of the national prevalence (Mathenge et al., 2010).

Diabetes can result in major complications: retinopathy, nephropathy, neuropathy, and cardiovascular systems dysfunction. During pregnancy, it is known to increase the risk of maternal and fetal complications (Saran et al., 2015). If diabetes remains unmanaged the complications become severe and are reported to cause at least one death every eight seconds (World Health Organization {WHO}, 2018). Those people reported to have died are usually of reproductive age (<60 years), this deaths are estimated at 69.2% in Africa but more so in Kenya at > 80% (IDF, 2017). These complications further cause an increase in the medical cost and eventually compromises the quality of life of the diabetic patient. The estimated cost of diabetes management globally is estimated at US Dollars (USD) 825 billion (Forouzanfar et al., 2016). The cost for the African region was estimated at 3.3 billion USD and is projected by IDF to increase to 6.0 billion USD2045 (IDF, 2017). Diabetic patients in Kenya attending public Hospitals are estimated to spend approximately 234 USD in diabetes management (Subramanian et al., 2018).

A series of cost-effective interventions can improve health outcomes (IDF, 2016). This involves use of appropriate diet, engaging in physical activity health education and use of medication and Knowledge provision (Kurnia et al., 2017; American Diabetes Association {ADA}, 2015). Similarly, a significant change in the level of knowledge among diabetic patients may lead to behavior change and thus an improvement in the patient glycemic control (Ahmed et al., 2015). Low level of knowledge however, may lead to poor diabetes management, and eventually, poor glycemic control (Assunção et al., 2017). Helping

patients improve their knowledge of diabetes may have a greater impact on treatment compliance thus reduce the occurrence rate of diabetes complications (El-Khawaga & Abdel-Wahab, 2015). It has also been observed that, a patients' knowledge plays an important role in improving the quality of life of diabetic patients (Fatema et al., 2017). There is need therefore for greater knowledge provision (Islam et al., 2014).

Long term complications of T2DM are as a result of poor diabetes management (Paswan et al., 2015). These complications are acute, and may include; hypoglycemia and hyperglycemic (Riza et al., 2016). Glycemic control is a crucial component of diabetes management which requires proper dietary management of DM, dietary intervention is considered the most important of all forms of diabetic management interventions strategies (Krishna et al., 2015). It is also considered a key pillar in the management of T2DM (Gupta et al., 2015). This is intervention strategy is however, proving to be a great challenge for most diabetic patients to implement (Mumu et al., 2014). It thus leads most of them to remain non-adherent to dietary recommendations (Mbutiti et al., 2016).

The predictors of Nutrition Status (NS); another crucial aspect in the management of diabetes, have been identified as: education level, monthly income, level of dietary knowledge and dietary practice (Wahome et al., 2018). A NS parameter Body Mass Index (BMI; in kg/m^2) has been associated with the rising risk of T2DM complications (Ganz et al., 2014). It has further been reported that most diabetic patients are obese because of poor dietary habits (Wahome et al., 2018). Poor dietary habits lead to poor glycemic control which also lead to increased risk of DM complications (Fasil et al., 2019). This is supported by another study which also reported that poor glycemic is associated with long-term organ

dysfunction (ADA, 2014). If diabetic patients adopted good dietary practices,they have a better chance of achieving good glycemic control and delayed development of diabetes complications (Raithatha et al., 2014).

In view of the increasing prevalence, severe consequences and the increased risk of death from diabetes in African and Kenya in particular, and in view of the role that diet plays in improving the prognosis diabetic patients, the need for more reliable and up-to-date data on nutrition knowledge, dietary practices and nutrition status of T2DM patients cannot be overstated. This study therefore assessed the nutrition knowledge, dietary practices and nutrition status of T2DM patients attending diabetic clinic at Nakuru Level 6 Hospital.

1.3 Statement of the problem

Diabetes prevalence is constantly on the rise; with an expected 48% increase in the number of cases to 629 million globally, whereas, African expects an alarming increase of 156%, by the year 2045 (IDF, 2017). The rise in prevalence is particularly significant because, evidence has shown that Diabetes if not properly managed leads to severe life threatening complications (Riza et al., 2016). The complications are so severe such that at least one person dies every eight seconds (World Health Organization {WHO}, 2018). This deaths have unfortunately been recorded amongst people of reproductive age (<60 years), with Africa reporting a 69.2% death prevalence but of great concern though is the Kenyan prevalence reported at > 80% (IDF, 2017). The significant number of deaths is worrisome specifically for Kenya because the DM prevalence is reported at 458,900 (2%), (IDF, 2017), with Nakuru, County recording a 6.6% prevalence (Mathenge et al., 2010). This continues to be the case despite the availability of various management

strategies; with dietary intervention considered as the most important intervention strategy (Krishna et al., 2015). If no deliberate efforts to curb this situation are adopted, this trend will continue and the future for diabetic patients is thus uncertain.

Adopting proper dietary practices has proven to be effective in the management of diabetes but this intervention has proven a challenge for most diabetic patients (Mumu et al., 2014). This challenge leads to non-adherence to dietary recommendations (Mbutiti, 2016). If good dietary practices are properly implemented the capacity of the diabetic patients to achieve good glycemic control and normal BMI; in kg/m^2 greatly improves. The predictors identified of dietary practices identified requiring further investigation are nutrition knowledge, level of education and income level (Wahome et al., 2018). Despite all this and the fact that Nakuru seems to contribute significantly (3 fold) to the national prevalence of T2DM, it would then be reasonable to determine the T2DM patients' nutrition knowledge, their dietary practices and nutrition status, in order to develop an effective intervention strategy. This study therefore intents to bridge this information gap by studying the nutrition knowledge, dietary practices and nutrition status of T2DM patients attending Diabetic Clinic at Nakuru Level 6 Hospital.

1.4 Purpose of the study

The purpose of this study was to investigate the nutritional knowledge, dietary practice and nutritional status of T2DM patients attending diabetic clinic at Nakuru Level 6 Hospital, Kenya.

1.5 Objectives of the study

This study was guided by the following specific objectives:

1. To assess the demographic and socio-economic characteristics of T2DM patients attending diabetic clinic at Nakuru level 6 Hospital
2. To establish the level of nutrition knowledge of T2DM patients attending diabetic clinic at Nakuru Level 6 Hospital
3. To assess the dietary practices among T2DM patients attending diabetic clinic at Nakuru Level 6 Hospital
4. To assess the nutrition status of T2DM patients attending diabetic clinic at Nakuru Level 6 Hospital
5. To determine the association between demographic and socio-economic characteristics, nutrition knowledge, dietary practice and nutrition status of T2DM patients attending diabetic clinic at Nakuru Level 6 Hospital

1.6 Research questions

1. What was the demographic and socio-economic characteristics of T2DM patients attending diabetic clinic at Nakuru level 6 Hospital?
2. What was the level of nutritional knowledge of T2DM patients attending diabetic clinic at Nakuru Level 6 Hospital?
3. What were the dietary practices of T2DM patients attending diabetic clinic at Nakuru Level 6 Hospital?
4. What was the nutritional status of T2DM patients attending diabetic clinic at Nakuru Level 6 Hospital?
5. What was the association between, demographic and socio-economic characteristics, nutrition knowledge, dietary practice and nutrition status of T2DM patients attending diabetic clinic at Nakuru Level 6 Hospital?

1.7 Justification of the study

According to global statistics, someone prematurely dies from diabetes complications in every 8 seconds (WHO, 2018). The people who die from diabetes before the age of 60 years in Africa is estimated at 69.2% and > 80% for Kenya (IDF, 2017). The Sustainable Development Goal (SDG) number 3 of Good Health and Wellbeing aims at reducing by one-third premature deaths from non-communicable diseases (WHO, 2018). Proper management of diabetes ensures good glycemic control and reduces the chances of complications associated with diabetes (Ganiyu et al., 2013). This study on nutrition knowledge, dietary practices and nutrition status of diabetic patients at Nakuru Level 6 Hospital, will get information that is important to health care workers and policy makers in developing appropriate health messages for the T2DM patients attending diabetic clinics.

1.8 Scope of the study

This study included T2DM patients aged ≥40 years and attending diabetic clinic at Nakuru level 6 Hospital. The study focused on the variables: nutrition knowledge, dietary practices and nutrition status (BMI; in kg/m^2 and Glycemic control) of diabetic patients at Nakuru level 6 Hospital.

1.9 Significance of the study

The results emanating from this study will go a long way in designing and implementation of nutrition services care services targeted for patients with T2DM within the hospital setup. The findings are also significant to the county department of health services during design and implementation of intervention programs targeting T2DM patients and in

organizing trainings for health care workers handling T2DM patients in the county. The findings will also be used as a basis of further studies.

1.10 Limitations of the study

1. Blood sugar levels was determined based on a single random test and therefore may not have provided a full picture of the patient's glycemic control.

2. Dietary adequacy was measured in the hospital setup as opposed to the recommended home setup and presented a challenge in measuring diet adequacy due to recall bias

1.11 Assumptions of the study

1. The attitudes did not affect dietary practices of patients with T2DM
2. The questionnaire that was used would elicit reliable responses from patients with T2DM

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter discussed in depth the various objectives of the study. It shows the socio-demographic characteristics of T2DM patients, which included the age, sex, marital status, religion, ethnic group, education status, work status, and monthly income. It looked at the general overview of DM and the nutrition knowledge the diabetic patients had on diabetes management; Various literature on dietary practices of T2DM patients were reviewed and how nutrition status was of T2DM patients was affected by both dietary practice and nutrition knowledge. Finally, it showed the summary of literature review and gaps addressed, and finally, conceptual framework: description and structure

2.2 General overview of Diabetes Mellitus

The DM global prevalence in 2013 was estimated at an approximate 387 million cases and was further projected to increase exponentially to 592 million by the year 2035 (IDF, 2013). The rising prevalence is also evidenced by the 2014 global statistics which estimates that the cases were 422 million (WHO, 2016). Furthermore in 2017, the Global statistics report an estimated prevalence of DM cases at 425 million, with a further projection of a 48% rise in DM cases by the year 2045 (IDF, 2017). These clearly demonstrates an increasing trend in the number of DM cases. The African continent is showing a similar trend in the increasing number of DM cases, it is reported that in 2015 Africa had 14.2 million DM cases and this number was further projected to increase to 34.2 million DM cases by the year 2040 (IDF, 2015). In 2017, the number of DM cases had shown a

significant increase in prevalence to 16 million, with a further expected rise in prevalence to 41 million by 2045. More than 6% of all the deaths in the African region are directly attributable to DM, with the most affected being the younger more productive generation aged 30-39 years (IDF, 2017).

Approximately, 50% of all Africans with DM are found in the Sub-Saharan African (SSA) region (IDF, 2015). Most of these SSA countries have registered a rise in the number of diabetic cases over the years. The leading country in terms of the prevalence of DM in the SSA region is South Africa which has reported an estimated 9% DM prevalence among people aged ≥30 years (Bertram, 2013). Kenya's DM prevalence is estimated at 458,900 cases, which is estimated at 2.0% (IDF, 2017). Kenya's national DM prevalence compared to that of Uganda is much higher, with Uganda reporting a prevalence of 1.4% (Bahendeka et al., 2016). In the year 2014, Kenya recorded an increased prevalence of DM cases in the urban areas as compared to the rural areas, with the prevalence being estimated at 12% for urban and 2.2% for rural areas (WHO, 2016). Around the same period of time, Ethiopia had an estimated diabetes prevalence of 5.1% for urban areas and 2.1% for rural areas (Asmamaw et al., 2015).

It is estimated that amongst all the reported cases reported of DM, T2DM is the most common accounting for approximately 90% of all the cases (Holman et al., 2015). A rise in the ageing population, eating of unhealthy food, obesity, and sedentary lifestyles are deemed as the main contributors to the rise in T2DM prevalence (Mabaso & Oduntan, 2019). DM also has severe physiological complications, if not properly managed it may lead to lifelong complications, and is associated with long-term target organ damage;

dysfunction, and collapse (ADA, 2012). It is crucial therefore, to identify the best interventions that improve the DM patient's knowledge and practices (Asdaq, 2018).

2.3 Demographic and socio-economic characteristics of patients with Diabetes Mellitus

Several socio-demographic and economic factors have been identified as predictors of DM management. Age in patients with diabetes, has been reported to have varying effects on the risk of vascular complications. According to a population-based retrospective cohort study, done in Ontario, Canada being of older age (>40 years), has been identified as a risk factor for myocardial infarction and stroke, and that age should be taken into account in targeting of risk reduction in people among people with living with DM (Booth et al., 2006;Vaccaro et al., 2004). Similarly, a United Kingdom Prospective Diabetes Study (UKPDS) showed a rise in prevalence of myocardial infarction, and hypertension with older age in newly diagnosed DM patients, age at diagnosis was also a significant predictor of the increasing prevalence of both during follow-up. Being of younger age at time of diagnosis was however, related to an increased risk of retinopathy and peripheral neuropathy (Davis et al., 1997). According to a report from another study among an urban population attending urban health centres in south Iran, DM is most prevalent among people with advanced age (>60 years), (22.9%) and of low education level (17.9%, $P < 0.001$) (Rahmanian et al., 2013). This is also supported by similar study done in Khorasan province, northeast Iran, which showed that, DM was most prevalent among the older age group (>60 years) at 10.9%, whereas, those who are retired 14.4%, and those with low education level at 6.1%, ($p<0.001$) (Azimi-Nezhad et al., 2008).

An Institutional based cross sectional study done in Mekelle City reported a significant association between level of income (P=0.001), patient's educational status (P<0.001), family history of diabetes (P=0.025) and their occupation (P=0.002) with diabetes knowledge level (Berhe, 2014). Another study done in Toronto, Canada reported professional drivers, manufacturing workers and cleaners are three times more at risk of T2DM as compared to university lecturers and physiotherapists. This portrays a significant association between occupation and risk of getting DM (Pugnaloni et al., 2020). Systematic review and meta-analysis papers on sedentary lifestyle and disease risk, submitted that there is a relationship between sedentary lifestyle and risk of getting DM (Biswas et al., 2015; Tremblay, 2010). Similarly a continuous cross-sectional surveys, done between the year 2000 to 2005 also reported that many people spend approximately a half of their day being sedentary (Jans et al., 2007; Miller & Brown, 2004).

A Study examining whether an association exists between illness-related DM social support (IRDSS) and glycemic control among middle-aged and older adults, illustrated that women when compared to men were better at controlling their glucose levels, with the prevalence of good glycemic control among women being 48.9% among whereas among men it was 51.1% (Mondesir et al., 2016). Similarly, another study also reported the factors associated with the suboptimal glycemic control were the male gender (OR: 2.6, 95% CI, 1.579-4.321), being of Asian ethnicity (OR: 1.4, 95% CI, 0.683-3.008), and that males were associated with poor glycemic control contrary to their female counterparts who had good glycemic control (Roy et al., 2016). A retrospective chart review of 264,000 DM patients, at an urban academic medical center in the United Stated (US) also reported, that White patients as compared to their Black counterparts had good glycemic control and a lower

prevalence of diabetes across all income quartiles (P<.001). Thus race plays a key role in diabetes control among patients who are economically stable (Heidemann et al., 2016). Similarly, a qualitative study conducted among Hispanic immigrants with type 2 diabetes and their family members living in the southeastern US, reported one of the perceived barriers to diabetes self-management as language barrier (Hu et al., 2013). Furthermore, another study reported that immigrants continue to face barriers to effective glycemic control due to several social factors: low income and education levels, language barriers, cultural beliefs, and limited social and medical support (Gonzalez-Zacarias et al., 2016). Physical activity is an important factor in the regulation of weight and glucose levels, however it is limited mainly due to the geographical location that the patients live in (Hu et al., 2013).

Another study has also reported the prevalence of DM at 11.6%, with men comprising of 11.1% and their female counterparts at 12.1%. It also reported that DM was also more prevalent among persons >60 years (22.9%), and those with low education level (17.9%). It was however noted that marital status was not significantly related to diabetes mellitus (P= 0.37) (Rahmanian et al., 2013). Another study revealed a lower prevalence of diabetes and improved adherence to diabetes treatment in patients who have spouses, and that non-married patients showed elevated relative risk of death compared those who are married, and that the effects continued to be strong after adjustment for other socioeconomic factors. (Johnson et al., 2000). A study aimed at assessing the role of marital status on glycemic control and self-management behaviors, further observed that married participants were more likely to adhere to their medications, there was however no significant difference in glycemic control with changes in exercise or diet (Haines et al., 2018). A qualitative study

focusing on the influence of marital relationships on personal beliefs and management strategies among DM patients observed that a lack of spousal support contributed to negative health behavior such as eating unhealthy foods, it however observed that whenever couples attend diabetes counseling sessions together there is a significant improvement in the outcomes (Beverly et al., 2008).

A study reported poorer diabetes care in women (35%) in comparison to men (65%). The same study established an association between gender and diet practices whereby men had 0.328 (95% CI: 0.184 - 0.585) times less chances of bad dietary practices compared to women. Gender differences are observed in reporting of symptoms, mode of diagnosis and certain self-management behaviors and thus there is a need to plan for a gender specific behavior change in communication strategy for better management of T2DM (Shrestha et al., 2013). Similarly another study also reported that the risk of Cardio-Vascular Disease is greater in women compared to men with T2DM, similarly, high blood pressure (HBP), low HDL cholesterol in the blood, and high triglycerides contributed to DM related Cardio-Vascular Disease risk which was also more in women than in men (Juutilainen et al., 2004).

Education level also plays a key role in glycemic control. One study observed that patients who have at least a high school level of education had a good glycemic control when compared to those with lower education levels, this therefore means that a patient's education is an important component of diabetes management (WHO, 2016). Another study established significant associations ($P<0.05$) between participants' level of education (AOR=4.72), occupation (AOR=2.41), monthly income (AOR=6.02) and level of dietary knowledge (AOR=2.33) and their dietary practices and that high level of education is

observed to lead to better nutrition knowledge and eventually a good nutrition status (Wahome et al., 2018). A cross-sectional survey conducted on Jewish adults with DM in a medical center in northern Israel reported that patients with religious beliefs and fatalistic attitude had good DM management, with fatalism being significantly associated with glycemic control (P=0.01). This was also attributed to good emotional and practical support that religion offered (Berardi & Bellettiere, 2015). Furthermore another study employed a mixed methodological approach to determine illness beliefs, fatalism, health outcomes and demographics among patients with DM determine that having a fatalistic attitude had an influence on the management practices of DM patients, believing that God controlled their diabetes was mostly expressed by the older British South Asians (Patel et al., 2015).

Having a family history of DM is associated with a greater prevalence of DM (OR: 2.72, {95% CI 2.48, and 2.99}). Greater risk is further observed in those with both parents having a history of DM (OR:5.14{95%CI:3.74,7.07}), especially those whose parents are diagnosed with diabetes at a younger age (<50 years), this is largely confined to maternal family history (Scott et al., 2013).

Finally, economic instability is associated with poor glycemic control and an increase in diabetes complications because of the inability to afford healthy food, to do exercise and to access proper health care. This economic instability may lead to poor weight management and indulgence in unhealthy habits like: smoking, and heavy alcohol consumption, thus raising the risk of developing chronic complications (Simons et al., 2017). Good diabetes outcomes however, is associated with a higher economics status, and quality of life (Walker et al., 2016). Individuals who are food insecure are considerably

more likely than food-secure individuals to have poor glycemic control, they are also more likely to report difficulty affording a diet suitable for a diabetic patient (49%, P= 0.001) (Seligman et al., 2012).

2.4 Nutrition Knowledge of Diabetes Mellitus Management

A study in Ireland demonstrated significantly low levels in knowledge among T2DM patients relating to the effect of foods on blood glucose levels, especially on the impact of macronutrients on blood glucose and lipids. Poor nutrition knowledge was also associated with lower sugar, fruit and vegetable Consumption. Diet related information , should thus be given to T2DM throughout their life span, this will improve nutrition knowledge and promote more balanced approaches to dietary self-management (Breen et al., 2015). Similarly, results from another study done in Pakistan showed that the knowledge of the T2DM patients about diabetic diet was poor with only 19% having good knowledge and the remaining 81% participants answering less than 50% correct responses. This deficit in knowledge was shown to contribute to the increase in the burden of the disease on population (Bano et al., 2017).

A study conducted in Ethiopia identified the ratio of diabetic patients who were not getting dietary knowledge in hospitals as 51.4%, leading to difficulty in selecting the recommended foods among 95% of the patients and only (39.2%) of the participants followed the recommended self-care practices on diabetes. (Ayele et al., 2012). Similarly, another study also established that diabetic patients who had poor nutrition knowledge were 4.47 times more likely to have poor dietary practices as compared to those who had good nutrition knowledge. Consequently, not receiving nutrition education in the hospitals,

dejection, difficulty in food choice, unavailability of healthy fruits and vegetables and generally the high cost of foods were factors that were significantly associated with the poor dietary practice (Worku et al., 2015). A study done in Kenya has reported 69.3% of diabetic patients as having poor nutrition knowledge and this is attributable to poor attendance to nutrition education sessions, with (52.3%) indicating that they did not attend the sessions, whereas 37.9% attend occasionally. Furthermore participants who had higher nutrition knowledge were more likely to have a higher Dietary Diversity Score (DDS) (Wahome et al.,, 2018).

Regular knowledge provision regarding diabetes will reduce healthcare burden and reduce the chances of long term complications of the disease, more so, assessment of patient's nutrition knowledge and dietary practices about DM is crucial in coming up with intervention strategies and developing of education material (Padma et al., 2012). Risk factors for DM can also be reduced and controlled through effective education and enhancement in the patient's knowledge provided in the health institutions, therefore, health institutions should encourage professionals to participate in continuous professional education activities, in order to learn about diabetes education and care (IDF, 2013). Poor nutrition knowledge is further associated with progression of diabetes and its complications, it is therefore important to provide health education regarding the diabetes management strategies, this will help patients to achieve good glycemic control (Padma et al., 2012). According to another study, there is evidence of a positive association between nutrition knowledge and dietary intake among DM patients, the association however was deemed weak. More over provision of nutrition knowledge to DM patients helps them make proper food choices that improve their quality of life (Spronk et al., 2014). It has

further been observed that dietary knowledge has the potential to change the undesirable dietary pattern among T2DM patients (Lesser et al., 2014).

Low levels of education among diabetic patients is a contributing factor to poor diabetes-related knowledge. Education provision aimed at behavior change will be achieved if the use of Food Based Dietary Guidelines (FBDGs) are adopted during provision of interventions that are holistic and multidisciplinary, and that take into account factors that influence dietary choice (Vorster, 2013). Finally, there is evidence that show that DM patients who are well educated and are keen on their diabetes care achieve better and sustainable diabetic control. It also reported that assisting DM patients learn and apply knowledge requires a delicate balance of many factors: clinical status, culture, values, family, and social and community environment (Powers et al., 2015).

2.5 Dietary practices of patients with Diabetes Mellitus

A patient's food choice that is based on the information gained through nutrition education puts an emphasis on the intake of nutrient-dense carbohydrate sources that are high in fiber, including vegetables, fruits, legumes, whole grains, as well as dairy products, and food with low sodium levels. T2DM patients, who are on insulin therapy require education on the use of carbohydrate counting, and the consideration of fat and protein content in order to determine mealtime insulin dosage to improve glycemic control (Gray & Threlkeld, 2015). Another study done in Bahrain reported that Patients who constantly received good family support had high motivation to see a dietician and to follow diet regimen. Consequently, inadequate dietary assessment, intervention and follow-up by health care

professionals are some of the main determinants of dietary practice among T2DM patients (Shamsi et al., 2013).

Various studies globally have shown a difference in dietary practices. A study in the United States, found no difference in the dietary practices of the people with or without DM (Morton et al., 2012). According to a study done in Oman, good dietary practice have been estimated at 56%. It also reported that glycemic control had a significant association with DM patients adherence to diet (p = 0,036) and exercise (p = 0,006) (Faria et al., 2013). Another study in Brazil reported that dietary practices of DM patients was poor, with most DM patients consuming unhealthy foods such as fried food (51.0%) and soda (57.9%), fruit was the least consumed (11.1%). Furthermore, women had better dietary practices as compared to their male counterparts (Ozcariz et al., 2015). Similarly, a study done in Saudi Arabia reported that dietary practices were inadequate and required urgent improvement. Poor dietary practices was reported at 50%, reasons for this prevalence were reported as: Inadequate nutrition education, despondency, inability to correctly choose foods relevant for their health condition and unavailability or high cost of foods (Worku et al., 2015).

Some of the Sub-Saharan African countries like Ethiopian have shown some indication that only 35.9% of the patients had good dietary practice. The predictors identified for dietary practices whereby: attaining a secondary or tertiary level of education (AOR=1.9), good family support (AOR=2.6), and proper nutrition education (AOR=2.5). The findings indicated the need for nutrition education for both patients and their families (Demilew et al., 2018). According to Hailu et al. (2012) Only (55.6%) of DM patients had regular meals, of the patients who were on insulin, approximately (45.9%) took meals

30 minutes after the injection, whereas the rest injected themselves before meals, this negatively affected their glycemic control. One of the studies carried out in Kenya, one of the Sub-Saharan African countries with the highest number of T2DM patients, has revealed that knowledge on diabetes diet, patients education level, their occupation and monthly salary are associated with the patients' dietary practices and nutrition status (Wahome et al., 2018).

Good dietary practices have been identified as crucial in the effective and successful management of T2DM. DM self-management can be improved by enhancing behaviors, consuming a healthy diet, participating in regular exercising, regularly monitoring blood sugar level and regular taking medication as prescribed by a medical practitioner (Kurnia et al., 2017). Though good dietary practice is considered crucial in the management of T2DM, poor dietary practice is reported to be high among them. On adherence, approximately 87.5% of DM patients never adhered to dietary recommendations. Adherence to dietary recommendation was however higher in males than females ($p = 0.001$). The results also indicated that with increasing age adherence to dietary recommendation also decreased ($P=0.06$) and was positively correlated with the knowledge about diabetes mellitus ($r = 0.115$, $p = 0.024$) (Parajuli et al., 2014). Similarly, the rates of non-adherence to diet were 37% and the main reasons for this were indicated as lack of self-discipline (63.4%); inadequate information (33.3%) and eating out (31.7%). Also among the reasons identified for poor dietary practice was the poor taste of food, inadequacy of information on diabetes, economic related factors and increased amount of time spent away from home (Ganiyu et al., 2013). Adherence to dietary recommendations has been shown to improve the outcome of disease, and prevents the T2DM patients from

developing major complications of diabetes. Non-adherence to dietary recommendations among DM patients' was associated with poor acceptance level (P=0.010). Likewise, irregular blood glucose testing was associated with poor disease acceptance level (P=0.000). However, the irregular blood glucose testing and poor acceptance had negative impacts on adherence to dietary recommendations (Jaworski et al., 2018). Self-care practices among T2DM patients was unsatisfactory in most aspects apart from blood sugar monitoring and adherence to treatment. Many T2DM patients were also non-adherent to dietary recommendations (Mbutiti, 2016). In order to improve dietary practices, individualized dietary counseling is recommended for T2DM patients (Forouhi et al., 2018).

Dietary recommendations for the management of T2DM include limiting the amount saturated fatty acid consumption to less than 10% of total energy intake, and consuming of adequate amounts of fiber from the diet to an approximate intake of 20 grams daily and this can be through consumption of wholegrain cereals, legumes, fruits and vegetable (IDF, 2015). Other dietary recommendations include: replacing saturated fats with unsaturated fats, lower calorie intake for overweight patients, avoiding tobacco use, excessive alcohol use and added sugar (Ley et al., 2014). Other studies also showed that low carbohydrate intake is recommended for persons with DM because it may result in improved glycemic control. Emphasis has been placed on nutrient-dense carbohydrate sources that are high in fiber. Approximately 20-35g or (14 g of fiber per 1,000 kcal) are also recommended. Similarly, slightly higher amounts of proteins are recommended (20-30%) (ADA, 2019). It is further recommended that fat should contribute to approximately 20%-35% of the total calories in a diabetic person's meal (Lupton et al., 2002; Vannice

& Rasmussen, 2014). Consumption of saturated fat should however follow the guidelines of the general population (Evert et al., 2014). There is however, no clear evidence that dietary supplementation with vitamins, minerals, has an effect on the glycemic control (ADA, 2019). Findings from a systematic review done on the effects of micronutrients on DM however showed that the level of Selenium (Se) and Copper (Cu) was higher when HBA1C was higher. Further, the level of Mg, P, K, & Vitamin D correlated inversely with HBA1C. Some studies reported increased levels of Zinc (Zn) in DM subjects while others reported a decrease (Kiprotich+ et al., 2021).

Finally, another study showed that there is an association between the regular consumption of sugar-sweetened beverages and a greater incidence of T2DM. Similarly, consumption of artificially sweetened drinks and fruit juice also showed positive associations (Imamura et al., 2015). Some of the other factors associated with T2DM incidences include inadequate intake of fruit and vegetables, whole grains and dietary fiber and high intake of energy as saturated fat (Mozaffarian, 2017).

2.6 Nutrition status of DM patients

Approximately (60.5%) of DM, patients had poor glycemic control (FBS ≥152 mg/dL). The proportion of poor glycemic control among T2DM patients was (59.8%). Factors that significantly reduce poor glycemic control was identified as being aged ≥65 years (AOR: 0.070), being divorced (AOR: 0.226), and increased waist circumference (AOR: 0.361). Interestingly, diabetes complications among DM patients were also higher in insulin (72.5%) and tablet users (64.5%) and those patients who had poor glycemic control (37.3%) (Fasil et al., 2019). Individuals with a fasting blood sugar (FBS) levels of ≥152

mg/dl are described as having poor glycemic control (ADA, 2017). Poorly managed blood glucose levels are associated with long-term organ dysfunction (ADA, 2014). Good glycemic control can prevent DM complications; DM patients who don't achieve proper glycemic control (A1C levels >10%) and those with symptomatic hyperglycemia can achieve it with a combined basal and mealtime bolus insulin. It is however important to avoid hypoglycemia since patients with a history of severe hypoglycemic are 4 times more likely to die. Results showed that approximately 15% of insulin-treated patients experience at least one annual episode of hypoglycemia and an estimated 2% have severe hypoglycemia (Garber et al., 2013). It has been also observed that good glycemic control may prevent cardiovascular complications and mortality especially among the newly diagnosed patients (Zhang et al., 2015).

A T2DM patient is required to have good dietary practices so as to have optimal glycemic control and to delay or prevent major diabetes complications (Raithatha et al., 2014). Good dietary practices helps T2DM patients to always have a good blood glucose level control. DM patients using a fixed daily insulin doses and with consistent routine of carbohydrate intake with a proper consideration of time and amount will have improved glycemic control and a reduced risk for hypoglycemia. It is further recommended that meal planning approach such as portion control may be better suited to individuals with T2DM (Evert et al., 2014). Another study also observed that proper dietary interventions are recommended for the reduction of blood glucose levels and thus forms an integral part in preventing and management of risk factors and in achieving good quality of life for a DM patient (Worku et al., 2015). A similar study reported that dietary factors are associated with a significant proportion of deaths T2DM complications. It is however worthwhile to note that the health

outcomes of T2DM patients can be improved in order to prevent this deaths by maintaining good dietary habits (Micha et al., 2018). In their everyday life, DM patients are expected to make decisions about choice of food, this is crucial in regulating their blood glucose levels. However, many T2DM patients are unaware of the importance of diet in proper glycemic control (Worku et al., 2015).

Results from a cohort study done in Scotland showed that individuals with morbid obesity (BMI ≥35 kg/m2) and those of normal BMI; in kg/m^2, within a year after diagnosis of T2DM have an increased risk of mortality compared with people who are at the overweight category (BMI-25 to 30 kg/m2) (Logue et al., 2013). Over weight and obesity at a younger age, substantially increases risk of being diagnosed with diabetes, their impact on DM risk and life expectancy reduces with the individuals age (Narayan, 2007). The prevalence of obesity among individuals at the time they are first diagnosed with diabetes has been shown to increase over time. This is particularly disturbing since diabetic individuals who are extremely obese are at increased risk of mortality(Leibson et al., 2001).

Consumption of highly processed, energy-dense food combined with a sedentary lifestyle contributes to the emergence of obesity and eventually increased cardio-vascular disease risk among T2DM patients. Increased body weight has been identified as a risk factor for T2DM, this is however attributable to the quantity and distribution of body fat. Similarly, no matter the BMI; in kg/m^2 value of an individual, increased waist circumference is directly associated with increased abdominal fat level (Després, 2012). Before an individual develops T2DM, there progressive increase in weight has been observed, however, after diagnosis, there is usually a tendency toward weight loss. Weight-loss

interventions in people with diabetes is therefore crucial in order to successfully modify the course of the disease (Looker et al., 2001).

2.7 Summary of literature review and gaps addressed

T2DM is a global burden requiring proper and aggressive management to prevent future long-term complications and reduce the rates of mortality related to diabetes. Despite the fact that poor nutrition knowledge is associated with progression of diabetes and its complications (Padma et al., 2012), there is still an increase in knowledge deficiency among larger population of diabetic patients (Breen et al., 2015; Ayele et al., 2012; Wahome et al.,, 2018). Low levels of education among diabetic patients are a contributing factor to poor diabetes-related knowledge (Vorster, 2013). Therefore, finding better ways of knowledge provision is crucial as management strategy (Padma et al., 2012).

Good dietary practices have been identified as crucial in the effective and successful management of T2DM (Kurnia et al., 2017), but despite this revelation, there is still generally poor dietary practices among diabetic patients (Ozcariz et al., 2015; Worku et al., 2015; Demilew et al., 2018). This has been further reinforced by a study done in the US that established there being no difference in the dietary practices of the people with and those without DM (Morton et al., 2012). Inadequate dietary assessment, intervention and follow-up by health care professionals have been identified as some of the main contributing factors to poor dietary practice among T2DM patients (Shamsi et al., 2013). Further investigation is required to determine why dietary practices are still insufficient.

Poorly managed blood glucose levels are associated with long-term organ dysfunction (ADA, 2014). Despite there being significant complications for unmanaged diabetes there

are still increased number of diabetic patients with poor glycemic control (Fasil et al., 2019). Good glycemic control can however prevent nephropathy, retinopathy, and neuropathy among T2DM patients (Garber et al., 2013). Furthermore, Individuals with morbid obesity (BMI; in kg/m^2 ≥35 kg/m2), within a year after diagnosis with T2DM have an increased risk of mortality (Logue et al., 2013). There is need therefore to do everything necessary to achieve good glycemic and BMI; in kg/m^2 for patients with T2DM.

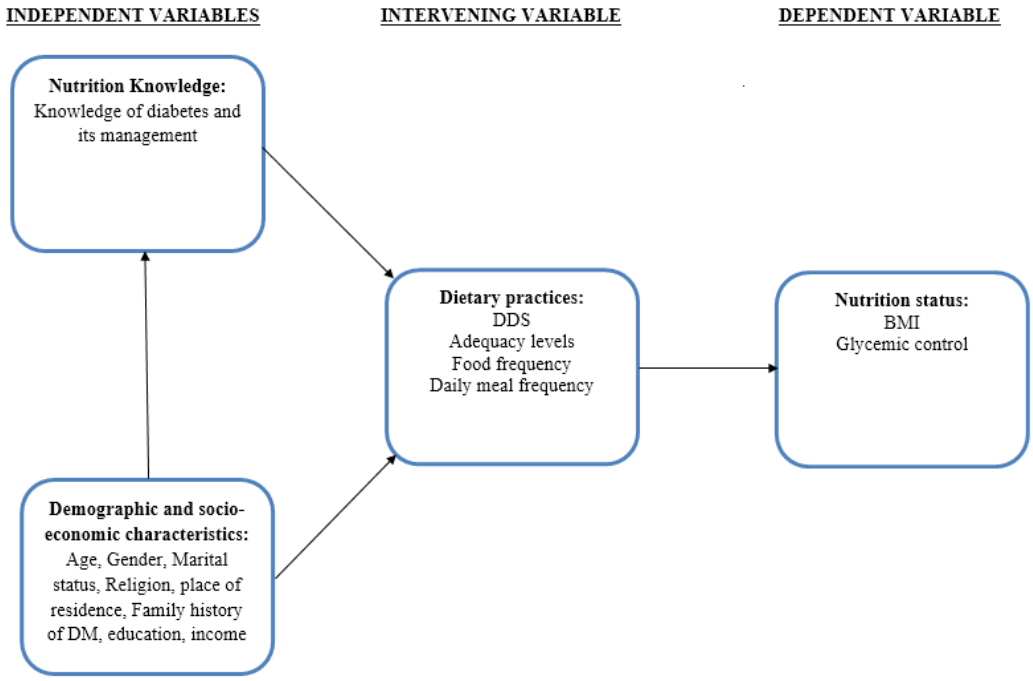
Despite this revelation, there is limited literature on the nutrition knowledge, dietary practice and nutrition status among diabetic patients in Kenya. This study therefore seeks to determine the association between nutrition knowledge, dietary practice and nutrition status (glycemic control and BMI; in kg/m^2) of T2DM patients attending diabetic clinic at Nakuru level 6 Hospital.

2.8 Conceptual framework

This conceptual frame was adopted from a systematic review on the Knowledge attitude and practice of diabetic patients (Wan, Rav-Marathe & Marathe, 2016). Demographic and socio-economic characteristics of T2DM patients is an independent variable which has an effect on their nutrition knowledge and dietary practices. Nutrition knowledge of T2DM patients is also an independent variable which has an effect on the dietary practices of this patients. Dietary practices on the other hand is an intervening variable with a direct effect on the nutrition status of the T2DM patients. Nutrition knowledge of T2DM patients is thus the dependent variable.

Figure 1

Conceptual framework on nutrition knowledge, dietary practices and nutrition status of T2DM patients attending diabetic clinic at Nakuru level 6 Hospital, Kenya



Note: ***Adopted from a systematic review journal, by Wan, Rav-Marathe & Marathe, (2016).***

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter presents the type of research design, and a justification for the choice of the design. It discusses the study location, justification of the choice of the location and the discussion on the characteristics unique to the site that are relevant to the study problem. It describes the population, which the sample was selected, and a justification for the choice of the target population. It also looks at the Sample size determination and Sampling procedure. Instrumentation section described the tools for data collection. It also documents where, and why the pretest was undertaken. Finally, it documents the measures that were taken to ensure construct, content and other types of validity and the instruments reliability.

3.2 Research design

This research adopted a descriptive cross-sectional study design, employing quantitative approaches to investigate the nutrition knowledge, dietary practices and nutrition status of T2DM patients attending diabetic clinic at Nakuru level 6 Hospital. This design was relevant to this study because it is cost effective and fast for description and explanation of variables (Setia, 2016). It is the most relevant design for assessing the prevalence of disease, the knowledge and attitudes of patients (Kesmodel, 2018). It is also suitable for examining the burden of the disease or condition and are useful for healthcare service planning (Pandis, 2014). In this study, the number of T2DM patients were determined

using scientifically sound methods and recruited for the study between November 2021 and January 2022.

3.3 Location of the study

The study was conducted at Nakuru level 6 Hospital which is one of the largest referral hospital in Kenya, located in Nakuru City County. Nakuru Level 6 Hospital, formerly known as Rift Valley Provincial General Hospital was founded in 1906 as a military hospital and was gazetted as a public hospital in 1956. In 2019, the hospital was elevated from level 5 into a level 6 facility making it a national referral hospital. The hospital serves a population of about 1.6 million people a cross various counties within the region (Bastawrous et al., 2017). It also serves about 1000 diabetic patients of which 700 are expected to attend diabetic clinic every month (Ngugi, 2020). Nakuru level 6 Hospital as a study site was ideal for the study because it receives patients from across the county where prevalence of DM has been reported at 6.6% (Mathenge et al., 2010). This prevalence significantly higher than the national prevalence estimated at 2.0% (IDF, 2017).

3.4 Population of the study

The study population included adults 40 years and above, and with T2DM; they include patients who attend the diabetic clinic at Nakuru level 6 Hospital on monthly basis.

3.5 Inclusion criteria

The patients needed to be at least 40 years, and having attended the diabetic clinic at Nakuru level 6 Hospital for at least 2 sessions. The patient should have been diagnosed with T2DM and should have known their diagnosis for at least a period of 6 months.

3.6 Exclusion criteria

Diabetic patients who were critically ill were excluded from the study. Patients with type 1 diabetes were also excluded from the study. Those who did not consent to participate in the study were also excluded

3.7 Sample size determination and sampling procedure

3.7.1 Sample size

Fisher's sample size calculation formula (Fisher *et al., 1998) as* quoted by (Mugenda & Mugenda, 2003), was used to determine the sample size: $\mathbf{N=Z^2pq/\ d^2}$

Where:

N –the population sample

Z –the standard normal deviate, which corresponds 95% confidence level (1.96)

p – Number of T2DM patients attending diabetic clinic and Nakuru level 6 Hospital on a monthly basis (Number of T2DM cases are unknown)

q- (1- p) = 0.5

d = 0.05 (statistically tolerated error)

N= 1.96^2 x 0.5 x 0.5 / 0.05^2 = 384 (T2DM patients)

Since, the population of T2DM patients attending diabetic clinic and Nakuru level 6 Hospital was less than 10,000; the sample was adjusted as follows:

Adjusted sample:

(nf) = n/1+n/N

Where:

n=384 (calculated sample size)

N=700 (The population of DM patients attending diabetic clinic at Nakuru level 6 Hospital every month)

nf = 384/ 1+384/700 = 248

nf = 248+10% non-response=248+25=273

nf =273 (T2DM patients)

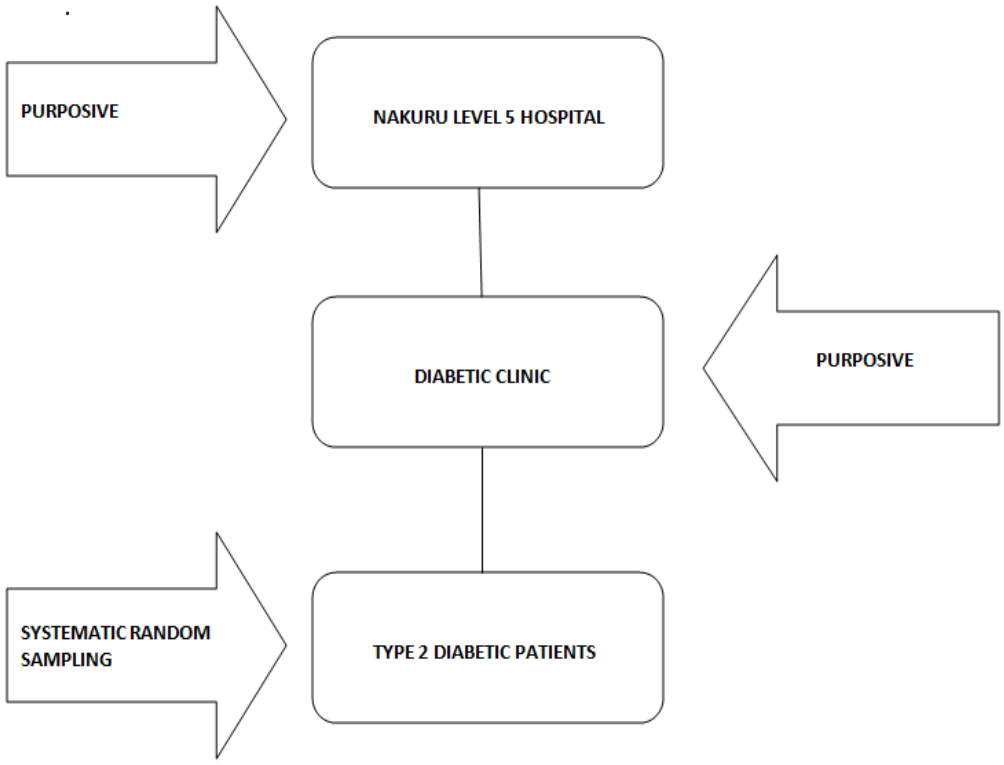
3.7.2 Sampling procedure

Different sampling method were used in this study. Nakuru Level 6 Hospital and the Diabetic Clinic were selected using purposive sampling method. Systematic random sampling method was however used to select the study participants.

A list of all T2DM patients was obtained from the Diabetic Clinic Center of Excellence database, the first participant was then randomly selected from the list using a table of random numbers whereas, the other study participants were then selected using systematic random sampling method. This involved selection study participants at intervals of 3, whereby every 3rd participant who met the inclusion criteria and consented to participate in the study was selected.

Approximately 700 T2DM patients were expected to attend clinic on a monthly basis. An estimated 273 study participants were expected to be recruited into the study by the end of the month. This necessitated the recruitment of 68 participants every week.

Figure 2 Sampling procedure



3.8 Instrumentation

A semi-structured questionnaire was administered with the aid of trained research assistants. This was done in order to determine the nutrition knowledge, dietary practices and nutrition status of the study participants.

It had several sections:

1. Demographic and Socio-economic characteristics of patients, this had dichotomous and Likert questions section, data on the age, gender, marital status, religion,

duration with diabetes, family history of diabetes, education level, source of income and individual and household income.

2. Nutrition knowledge section had questions on the nutrition knowledge of the diabetic patients.

3. Dietary practices section had several sets of questionnaires: dietary diversity score, food frequency questionnaire and 24-hour recall.

4. The nutrition status section collected data on the weight, height, Body Mass Index (BMI; in kg/m^2), and random blood sugar levels.

5. The questionnaires had both open ended and closed-ended questions, which were dichotomous, multiple choice or Likert in nature.

3.9 Pretest

A pretest was carried out at Naivasha County Referral Hospital at the Outpatient Department Diabetic Clinic. The location was chosen because it has similar characteristics as the study location. 28 adult patients representing 10% of the calculated sample size, were randomly selected for the purpose of pretest. The participants were not to be part of the main study but had similar characteristics as those in the main study. This was conducted in order to make the necessary adjustments to the tools and instruments, test for validity and reliability, and to assess if patients had difficulties addressing certain questions, for the purposes of rephrasing them. Data from the pretest was analyzed using SPSS version 24 software.

3.10 Validity of the instrument

To ensure for validity the study was conducted using an instrument with properly phrased questions to enhance its accuracy. Similarly, properly designed and validated research instruments, recommended by FAO/FANTA, were adopted and modified to suit this study (Kennedy, Ballard & Dop, 2011). Validity was further ensured through the review of the tools by nutrition professional and the supervisors, the contextual meaning was then examined and content equivalence established to determine whether the content of each item of the tool was relevant to the target group.

3.11 Reliability of the instrument

Reliability was achieved through close supervision of the field assistants, increasing the number of questions and rewriting ambiguous questions to make them clearer. Reliability of the research instruments was ascertained by analyzing the data obtained from the pre-testing exercise. Internal reliability was tested using Cronbach's alpha test and a reliability coefficient of 0.753 was reported.

3.12 Data collection procedure

Prior to the commencement of the study; Approval to conduct the study was sought from Graduate school and clearance was sought from Kabarak University Research and Ethics Committee. Permit was obtained from National Commission for Science, Technology and Innovation (NACOSTI), the County Government Health Director and Nakuru level 6 Hospital management. Written consent from the DM patients was sought prior to conducting the study; a pre-visit was then done at Naivasha County Referral Hospital in order to test the research instruments. Research assistants were then, trained and oriented

on the various aspects of the research including the research tools and instruments. T2DM patients were then identified and recruited into the study; this was done only after obtaining a duly signed written consent from them. Data was then collected from the eligible participants using a semi-structured questionnaire.

Data on demographic and socio-economic characteristics, nutrition knowledge and dietary practices and nutrition status was collected. The nutrition status of the diabetic patients was determined using Body Mass Index (BMI; in kg/m2) and Random Blood Sugar levels. The weight was determined using a calibrated weighing scale placed on a flat surface and measured to the nearest 0.1 kg. Whereas the height was determined using a stadiometer and the measurements done to the nearest 0.1 cm. Patients were weighed after taking off heavy clothing and shoes and their height was measured when the patients were barefoot or with socks. Information on the random blood sugar levels of that day were retrieved from the records.

Dietary practice was determined using: dietary diversity score, food frequency questionnaire, and 24-hour recall; In order to establish the nutrient intake of the participants, the 24 hour dietary recall was conducted on two separate occasions. The 24-hour recall entailed asking the participants to list all the foods and beverages consumed in the past 24 hours. If the participants forgot any foods and beverages from the list of items consumed, a list of food items were solicited. Starting with the first food item on the list, participants were probed for details of the food items in terms of type of food, quantity, ingredients used and preparation method. Food models, pictures and volume cups were used to estimate the quantities of food and beverages consumed. The standard procedures

employed to collect 24-hour recall data were as recommended by other studies (Boushey et al., 2013; Steyn & Nel, 2006).

The following activities were done to ensure privacy and confidentiality of the study participants and the safety of the data collected:

- Informed consent was obtained from all study subjects before collection of data
- Subjects were physically approached after being attended by the resident clinician/nurse;
- After explaining the study details to them, those who agreed to participate were taken through the consenting process;
- The researcher administered the questionnaire in a private room within the diabetic clinic to the subjects who agree to participate in the study. The lead researcher only handled subjects during official working hours. Any question that was not clear was explained further by the researcher;
- The lead researcher collected data from subjects. Solely the lead researcher handled these data.
- All subject's data were handled by the lead researcher in high confidence. No other party was allowed access to the data. Publishing only involved coded data.
- The lead researcher stored all data about subjects in high confidence and in a lockable box

3.13 Data analysis

The collected data was taken through a data cleaning process to check for completeness and consistency of information, it was then coded and entered into a Microsoft office excel

spreadsheet. The data was exported from excel to SPSS version 24 software. Statistical parameters that were used to describe the data on nutrition knowledge, dietary practice and nutrition status were descriptive statistics such as Mean, standard deviation (SD), and percentage. The association between the dependent and independent variables were determined using Chi- square test and Binomial logistic regression. The p-value was determined to verify the statistical significance of the study findings, and if the p-value was found to be <0.05 the findings will then be regarded as statistically significant and thus accepted.

Table 1

Data analysis matrix

Objectives	Variables	Nature of variables	Statistical analysis
To determine the demographic and socio-economic characteristics of diabetes among diabetic patients attending diabetic clinic at Nakuru Level 6 Hospital	Age sex marital Status Education level Income source Individual income Household income	Continuous Categorical	Descriptive statistics e.g. Mean, Standard deviation, Percentages
To assess the level of nutrition knowledge of diabetes among diabetic patients attending diabetic clinic at Nakuru Level 6 Hospital	Nutrition knowledge	Continuous	Descriptive statistics e.g. Percentages
To determine the dietary practices of diabetic patients attending diabetic clinic at Nakuru Level 6 Hospital	Dietary diversity, Food frequency, Number of meals, Adequacy levels	Continuous	Descriptive statistics e.g. Percentages
To determine the nutrition status of diabetic patients attending diabetic clinic at Nakuru Level 6 Hospital	BMI; in kg/m^2, Blood sugar levels	Continuous	Descriptive statistics e.g. Percentages
To determine the Association between knowledge, dietary practice and nutrition status (BMI; in kg/m^2 and glucose levels) among diabetic patients attending diabetic clinic at Nakuru Level 6 Hospital	Nutrition knowledge, DDS, Body Mass Index Glucose Levels	Continuous Categorical	Pearson's Chi-square, Binomial logistic regression.

The demographic and socio-economic characteristics were analyzed using descriptive statistics; Mean, Median, Standard deviation, Percentages. Nutrition knowledge was analyzed using descriptive statistics. The diabetes knowledge score was classified into: good (≥69), fair (40-69), and poor (<40) (Wahome et al., 2018). The study participant's

nutrition knowledge was then categorized as having either; poor knowledge, average knowledge or good knowledge. Dietary practice was analyzed using descriptive statistics. Dietary diversity data of participants was analyzed as a dichotomous variable according to the global dietary diversity indicator for women (the Minimum Dietary Diversity for Women by (FAO, 2011). Dietary diversity scores (DDS) of the participants were established based on their consumption of the different food groups. The study participant's dietary practice was then categorized as being: low, moderate, or High; this will then be converted to the percentage of each category. Nutrition status was analyzed using BMI; in kg/m^2 and blood glucose levels. The BMI; in kg/m^2 was determined using the formula; body weight (kg)/ (height (m))^2. The study participants were then classified based on the WHO classification of: (<18.5) for underweight, (18.5 - 24.9) for normal, (≥ 25- 29.9) for overweight and (≥ 30) for obese. Glucose levels were determined by taking the random blood sugar levels. The Association between nutrition knowledge, demographic and socio-economic characteristics, dietary practice and nutrition status was determined using Pearson's chi- square test, and binomial logistic regression. Data on the 24-hour recall were analyzed using nutria-survey software. The analyzed data will then be presented using graphical methods and by use of frequency distribution tables.

3.15 Ethical considerations

Approval to conduct the study was first sought from the Institute of Post Graduate Studies of Kabarak University (IPGS). Study clearance was then sought from Kabarak University Research and Ethics Committee (KUREC: KABU01/KUREC/001/06/05/21). A License to conduct research was consequently obtained from National Commission for Science, Technology and Innovation (NACOSTI: NACOSTI/P/21/11385). Permission to conduct

research was further obtained from the County Director of Health Services, and finally, Nakuru Level 6 Hospital Management. A duly signed written consent (annexed herein) from T2DM patients was sought prior to conducting the research.

The informed consent process was conducted as follows:

i. It was administered by the lead researcher;
ii. It was at the Nakuru Level 6 Hospital DM clinic when T2DM patients come for clinical visits;
iii. Details of the study including; brief background, benefits, risks, voluntariness, etc., were properly explained to the prospective participant before recruitment;
iv. The process was one-off
v. Any subject who declined to sign the informed consent form was automatically excluded from the study
vi. Data was handled and managed in high confidentiality by the researcher, it was stored in a password protected electronic device
vii. Findings shall be safely disseminated after analysis in form of a publication in a refereed peer reviewed journal

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSIONS

4.1 Introduction

This chapter will report the results generated through data analysis process, and the discussion of the findings

4.2 Demographic characteristics of patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Table 2

Demographic characteristics of patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Variable	**Category**	**N(262)**	
		N	**%**
Gender	Male	154	58.8*
	Female	108	41.2
Age	40	14	5.3
	41-50	94	35.9*
	51-60	62	23.7
	61-70	48	18.3
	71-80	35	13.4
	>80	9	3.4
	Mean ± SD	56.6±12.8	
Marital status	Married	209	79.8*
	Not Married	53	20.2
Sub-county of residence	Nakuru town	187	71.4*

Variable	Category	N(262)	
		N	**%**
	Subukia	10	3.8
	Naivasha region	18	6.9
	Molo region	32	12.2
	Kuresoi	3	1.1
	Neighboring counties	12	4.6
Religion	Christian	252	96.2
	Muslim	6	2.3
	Atheistic	4	1.5
Years with diabetes	1-5	138	52.7*
	6-10	61	23.3
	11-15	35	13.4
	16-20	14	5.3
	21-25	9	3.4
	>25	5	1.9
	Mean ± SD	7.2±6.6	
Family history of diabetes	**With**	157	59.1*
	Without	105	40.1

*Majority

Only 262 T2DM patients attending Nakuru Level 6 Hospital were interviewed out of the expected 273, this represents 96% response rate. The total respondents in this study were 262, with the majority 154 (58.8%) being males and minority (41.2%) being female respondents. Majority of the respondents were within the age group of 41-50 years

accounting for (35.9%) respondents, whereas the least were above the age of >80 years with (3.4%), with a mean age of and a standard deviation of 12.8. A majority of respondents (79.8%) were married. The most dominant religion among the respondents was Christianity with (96.2%). Majority of the respondents (71.4%) came from Nakuru town sub counties. Most of the respondents (52.7%) had known their diabetic status for a period of 1-5 years, with a mean of 7.2 and standard deviation of 6.6 as shown in Table 4. 1.

4.3 Socio-economic characteristics of patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Table 3

Socio-economic characteristics of patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Variables	**Category**	**N(262)**	
		N	**%**
Level of Education	No formal education	27	10.3
	Primary education	59	22.5
	Secondary education	112	42.7*
	Tertiary education	64	24.4
Source of Income	Dependent on others	41	15.6
	Informal employment	33	12.6
	Formal employment	46	17.6
	Business	83	31.7*
	Farming	59	22.5
Household Size	1 to 3	140	53.4*
	4 to 6	103	39.3
	7 to 9	16	6.1

Variables	Category	N(262)	
		N	**%**
	>9	3	1.1
	Mean ± SD	3.7±2.3	
Household income (Kshs)	0-10000	56	21.4
	10001-20000	82	31.3*
	20001-30000	63	24.0
	30001-40000	33	12.6
	40001-50000	22	8.4
	>50000	6	5.9
	Mean ± SD	23400±13731	
	Median	20000	
Weekly expenditure on food (Kshs)	0-1000	92	35.1
	1001-2000	133	50.8*
	2001-3000	27	10.3
	3001-4000	4	1.5
	4001-5000	2	8
	>5000	4	1.5
	Mean ± SD	1660±1768	

*Majority

Most of the study participants (53.4%) reported having 1-3 household members. Majority of the respondents, (42.7%) had attended secondary school, while (22.5%) had completed primary school, (10.3%) respondents had no formal education, and several (24.4%) had attended tertiary/university. The main source of income for the majority of the study participants (31.7%) was business, whereas (15.6%) were fully dependent on others. Majority of the respondents (31.3%) were earning a household income in the range of

10001-20000; the mean ± SD income amount was 23400±13731 and a median of 20000. 59.9% of the respondents indicated having a family history of DM, as shown in Table 4. 2.

4.4 Level of nutrition knowledge among patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Table 4

Level of nutrition knowledge of patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Level of Nutrition Knowledge	**N(262)**	
	N	**%**
<40 (Poor)	1	0.4
40-59 (Moderate)	11	4.2
≥60 (Good)	250	95.4*
Mean ± SD	82.2±11.2	

*Majority

Majority of the participants (95.4%) had good nutrition knowledge. Those with poor nutrition knowledge were (0.4%), whereas, those with moderate nutrition knowledge were (4.2%). The mean and standard deviation was 82.2±11.2 respectively, as shown in Table 4.3.

4.5 Dietary practice among patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

4.5.1 Food consumption frequency of patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Table 5

Food consumption frequency of patience with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

	Everyday	Twice a week	Once a week	Once a month	Seasonally	Never
	%	%	%	%	%	%
Vegetables	13.3	36.0	41.4	5.2	2.3	1.8
Fruits	1.9	20.0	36.8	15.4	10.9	15.0
Legumes	9.3	27.6	37.2	17.0	6.4	2.5
Animal products	23.5	30.2	34.4	7.4	3.3	1.3
Starch	40.3	26.0	18.4	5.3	4.7	5.2
Roots and tubers	5.6	22.8	33.1	21.6	11.8	5.1
Cooking oil	96.9	0.0	0.4	0.0	0.0	2.7
Sugars and sweets	1.0	0.6	0.5	3.2	7.4	87.3

Starches and cooking oil were the most consumed foods with a daily consumption rate of (40.3%) and (96.9%), respectively. Sugars and sweets however were mostly never consumed 87.3%. Vegetables (41.4%), fruits (36.8%), legumes (37.2%), animal products (34.4%), roots, and tubers (33.1%) were mostly consumed once a week, as show in Table 4.4.

4.5.2 Dietary diversity score of patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Table 6

Dietary diversity score of patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Category	Frequency	Percent
<4 (Low)	4	1.5
4-5 (Moderate)	70	26.7
>5 (High)	188	71.8*

*Majority

The majority of the participants (71.8%) had a high dietary diversity score; participants who had a moderate dietary diversity score at (26.7%) followed this closely, Only 4 (1.5%) had low dietary diversity score, as Shown in Table 4.5.

4.5.3 Dietary adequacy levels of patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Table 7
Dietary adequacy levels of patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

	RDA**		Intake (Mean ± SD)		Adequacy (%)	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
Energy (Kcal)	2000-2350	1800-2000	2204±433.4	2170.3±491.0	110	121
Carbohydrates (g)	130	130	303.2±59.6	298.4±67.5	233	230
Proteins (g)	56	46	82.7±16.3	81.4±18.4	148	177
Fats (g)	100-175	100-175	73.5±14.4	72.3±16.4	74*	72*
Dietary Fiber (g)	20-35	20-35	22.1±4.3	21.7±4.9	63*	62*
Vitamin A (µg RE)	600	500	628.4±123.5	618.6±139.9	105	124
Vitamin D (µg)	5.0	5.0	4.4±0.87	4.3±0.98	88*	86*
Vitamin B12 (mg)	2.4	2.4	2.7±0.53	2.6±0.6	113	108
Magnesium (mg)	260	220	304.3±59.8	299.5±67.8	117	136
Phosphorous (mg)	800	800	877.8±183.8	871.6±190.2	110	109
Iron (mg)	29	15	35.3±6.9	34.7±7.9	122	231
Selenium (µg)	130	110	142.5±29.8	141.6±30	110	129
Zinc (mg)	14	12	15.3±3.2	15.3±3.3	109	128

*Did not meet the adequacy levels

**RDA values were obtained from National Health and Medical Research Council (2005) Nutrient Reference Values for Australia and New Zealand.

The mean energy consumption was 2204 ±433.4 for male participants and 2170.3±491.0 for female participants, with majority of participants mean adequacy: male (110%) and female (121%) exceeding the recommendation for energy intake. The mean ± SD (g) consumption of the Carbohydrates, proteins and fats was: (303.2±59.6) for male and (298.4±67.5) female participants, (82.7±16.3) male and (81.4±18.4) female participants, (73.5±14.4) male and (72.3±16.4) female participants, respectively. The mean adequacy for carbohydrates intake was: (233%) for male, and (230%) for female participants. Similarly, protein was: (148%) for male and (177%) for female participants. However, adequacy for fats were: (42%) for male, and (41%) for female participants. Mean Adequacy levels for fiber was: (63%) for male and (62%) for female participants. The mean ± SD consumption being (22.1±4.3) for male participants and (21.7±4.9) for female participants.

Majority of the participants exceeded the adequacy levels for: Vitamin A (µg RE) male (105%), female (124%); Vitamin B12 (mg) male (113%), female(108%); Magnesium (mg) male (117%), female (136); Phosphorous (mg) male (110%), female (109%); Iron (mg) male (122), female (231%); Selenium (µg) male (110%), female (129%); Zinc (mg) male (109%), female (128%). Most however, did not meet the recommended adequacy levels for Vitamin D male (88%), female (86%), as shown in Table 4.6.

4.5.4 Number of daily meals consumed by patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Table 8

Daily meal frequency of patients with Type 2 Diabetes attending Diabetic Clinic at Nakuru Level 6 Hospital

Number of daily meals	Frequency (n)	Percent (%)
1	1	0.4
2	17	6.5
3	145	55.3*
>3	99	37.8
Total	262	100.0

*Majority

The results from this study showed that majority of the respondents had three meals daily (55.3%), similarly, a significant number of respondents also had more than three meals daily 99 (37.8%), However, a few respondents had 2 daily meals (6%) and only (0.4%) participant had 1 meal per day, as shown in Table 4.7.

4.6 Nutrition Status of patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

4.6.1 Body Mass Index of patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Table 9

Body mass index of patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Body Mass Index (Kg/m^2)	**Frequency (n)**	**Percent (%)**
<18.5 (Underweight)	6	2.3
18.5-24.9 (Normal)	103	39.3*
25.0-29.9 (Overweight)	82	31.3
≥30 (Obese)	71	27.1
Mean ± SD	26.6±5.4	

*Majority

Majority of the respondents had a normal BMI; in kg/m^2 103(39.3%), however, overweight (31.3%) patients were overweight and (27.1%) were obese. Those who were underweight were only (2.3%). The mean BMI; in kg/m^2 and standard deviation was 26.6 and 5.4 respectively, as shown in Table 4.8.

4.6.2 Glycemic Control among patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Table 10

Glycemic control among patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Random Blood Sugar (mmol/l)	Frequency (n)	Percentage (%)
<3.5	2	0.8
3.5-7.8	67	25.6
7.8-11.0	67	25.6
>11.0	126	48.1*
Mean	12.3±6.1	

*Majority

Most of the respondents (48.1%), had a random blood sugar (RBS) level of >11.0, an equal number of respondents had an RBS of 3.5-7.8 and 7.8-11.0 mmol/l (25.6%). Only (0.8%) presented with hypoglycemia (< 3.5 mmol/l). The Mean and standard deviation was 12.3 and 6.1, respectively, as shown in Table 4.9.

4.6.3 Association between study variables among patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Table 11

Association between study variables among patients with Type 2 Diabetes attending clinic at Nakuru Level 6 Hospital

Variables	**Categories**	**Nutrition Knowledge**		**P-Value**
		Good	**Poor**	**(<0.05)**
Family history of DM	With	147(56.1%)	10(3.8%)	
	Without	103(39.3%)	2(0.8%)	0.068
Level of education	Formal Education	227(86.6%)	8(3.1%)	
	No formal education	23(8.8%)	4(1.5%)	0.007*
Individual income	<20000	130(49.6%)	8(3.1%)	
	≥20000	120(45.8%)	4(1.5%)	0.01*
BMI; in kg/m^2	Normal	101	2(0.8%)	
	Malnourished	149	10(3.8%)	0.012*
Variables	**Categories**	**Dietary Diversity**		**P-Value**
		High	**Low**	**(<0.05)**
Level of education	No formal Education	21(8.0%)	6(2.3%)	
	Formal education	167(63.7%)	68(26.0%)	0.09
Household income	<20000	138(52.7%)	50(19.1%)	
	≥20000	50(19.1%)	24(9.2%)	0.018*
Nutrition Knowledge	Poor	11(4.2%)	1(0.4%)	
	Good	177(67.5%)	73(27.9%)	0.338
BMI; in kg/m^2	Normal	74(28.2%)	29(11.1%)	
	Malnourished	114(43.5%)	45(17.2%)	0.022*
Variables	**Categories**	**Glycemic Control**		**P-Value**
		Good	**Poor**	**(<0.05)**
Age (Years)	>45	54	148	
	<45	13	47	0.043
DDS	High	54	155	
	Low	13	40	0.366
Carbohydrates	Adequate	1	0	
	Inadequate	66	195	0.034*
Fiber	Adequate	38	132	
	Inadequate	29	63	0.016*
Variables	**Categories**	**Body Mass Index**		**P-Value**
		Normal	**Malnourished**	**(<0.05)**
DDS	High	74(28.2%)	114(43.5%)	
	Low	29(11.1%)	45(17.2%)	0.001*
Energy	Adequate	26(9.9%)	25(9.5%)	
	Inadequate	77(29.4%)	134(51.1%)	0.006*

* Significant P<0.05

Study participants' individual income (P≤0.01), level of education (P≤0.007) and BMI; in kg/m^2 (P≤0.012) had a significant association with nutrition knowledge. Household income (P≤0.018) and BMI; in kg/m^2 (P≤0.022) had a significant association with dietary diversity. Participant's random blood sugar levels had a significant association with the participant's carbohydrate (P≤0.034) and Fiber consumption (P≤0.016). BMI; in kg/m^2 also had a significant association with the respondent's DDS (P≤0.001) and Daily energy consumption (P≤0.006).

Table 12

Association between study variables among Type 2 Diabetic Patients attending clinic at Nakuru Level 6 Hospital

Variables	**Categories**	**AOR (95% CI) Nutrition Knowledge (Reference category: Good)**	**P-Value (<0.05)**
Family history of DM	With	1.00	
	Without	3.414(0.715,16.292)	0.124
Level of education	Formal Education	1.00	
	No formal education	3.921(1.012,15.195)	0.043*
Individual income	<20000	1.00	
	≥20000	1.274(0.322, 5.047)	0.003*
BMI; in kg/m^2	Normal	1.00	
	Malnourished	3.389(0.727,15.795)	0.183
Variables	**Categories**	**Dietary Diversity (Reference category: High)**	**P-Value (<0.05)**
Level of education	No formal Education	1.00	
	Formal education	1.319(0.497,3.500)	0.578
Household income	<20000	1.00	
	≥20000	1.325(0.738,2.378)	0.269
Nutrition Knowledge	Poor	1.00	
	Good	0.292(0.062,1.366)	0.118
BMI; in kg/m^2	Normal	1.00	
	Malnourished	1.021(0.062,1.366)	0.962
Variables	**Categories**	**Glycemic Control (Reference category: Good)**	**P-Value (<0.05)**
Age (Years)	>45	1.00	
	<45	1.319(0.662,2.627)	0.04*
Marital status	Married	1.00	
	Not Married	1.072(0.533,2.155)	0.845
Income source	Informal employment	1.00	
	Formal employment	1.114(0.530,2.340)	0.776

* Significant at P<0.05

Participants with no formal education were more likely to have good nutrition knowledge (AOR: 3.921) as compared to those with a formal education. Similarly, those participants who earn an income of ≥20000 were more likely to have good nutrition knowledge (AOR:

1.274) as compared to those who earn an income of <20000. Finally, participants who were younger <45 years were more likely to have a good glycemic control (AOR: 1.319) as compared to their older counterparts.

4.7 Discussion

Slightly more than half of male (58.8%) and a slightly lower number of female respondents (41.2%) have T2DM. This fact is confirmed by similar finding from Ethiopia, Mekelle and Ayder Referral Hospitals, male (57.7%), female (42.3%) (Berhe et al., 2014). This affirms the fact that males are more prone to T2DM as compared to their female counterparts though by a small margin, this holds true despite findings of a similar study showing that a 51.4%, of their respondents where female, whereas their male counterparts were 48.6% (Parajuli et al., 2014). Being male therefore is a risk factor for T2DM.

T2DM is prevalent among responded aged 41-50 years (35.9%), with a Mean and SD of 56.6 and 12.8 respectively. The same is observed by another study which reported a slightly lower prevalence among the same age group, 41-50 years (29%), with a corresponding Mean and SD of 54.4 and 11.5 respectively (Parajuli et al., 2014). More so, Padma et al. (2012) reported an even higher prevalence among the same age group, 41-50 years (45.3%). People in this age category are particularly vulnerable to T2DM and ought to therefore pay keen attention to healthy dietary practices. Contrary to this finding however, a similar study reported a significant prevalence (72.5%) in Kiambu Kenya, among respondents aged 51 to 70 years (Wahome et al., 2018). This clearly demonstrates though that the older one get the more likely they are to get T2DM.

Majority of the Kenyan population is mostly Christian and it was not alarming to have a large number of respondents (96.2%) being Christian, and given that most T2DM patients are mostly above 40 years of age it is the expectation that they are mostly married (79.8%). This also seems to be the case in Ethiopia where DebreTabor report shows a similar trend among T2DM patients: Christians (84.4%) and married 51.1% (Asmamaw et al., 2015). Most people with T2DM mostly reside in urban; this is observed from the findings showing that Nakuru city Sub Counties had the most cases (71.4%). This is confirmed by similar reports from University of Gondar Hospital, which reported a majority of their study participants coming from the urban areas 269 (73.3%) (Fasil et al., 2019). This clearly demonstrates that lifestyle changes associated with living in urban settlements play a significant role in the rising trend of T2DM cases. T2DM patients who have had diabetes for a longer period do not seem to attend clinic more often. This is observed by the study's findings that reported slightly more than half of the respondents (52.7%) having had diabetes for <5 years. This is further reinforced by Fasil et al. (2018) who also reported T2DM patients attending clinic having had diabetes for <7 years. It is apparent then that further research is required to determine why most T2DM patients stop coming to clinic as often as they used to.

Having a basic level of education seems to play a crucial role in clinic attendance among T2DM. This is observed from the results of this study that showed that (42.7%) had at least attained secondary school level of education, and is further reinforced by findings from Brazil that reported slightly more than half (51.8%) of the respondents had primary level of education (Assunção et al., 2017). This could be because of the fact that T2DM patients pursuing higher levels of education may have interacted with information on the

management of DM in the course of their studies and thus may not feel the need to attend clinic to get more information. Engaging in business related activities seems to be common among T2DM patients, they do so as a main source of income, (31.7%). this is however in contrast with another study that reported most of its respondents 54(38%) as having formal labor (Bano et al., 2017). This thus shows that T2DM patients have diverse sources of income. From this varied sources of income T2DM patients 82(31.3%) earn a meager household income of between Ksh 10001-20000., this observation has been further proved by findings from a similar study done by Wahome et al. (2018) whose respondents reported a monthly income of Kshs <20000 per month. This may eventually present a problem for the T2DM patients because not only are they expected to eat a varied diet but are also expected to constantly visit the hospital for regular checkups, all of which are costly.

Having a family history of diabetes is believed to predispose one to T2DM later on in life as observed in this study, which shore slightly more than half of the study respondents (59.9%) with a family history of DM. These findings are in agreement with findings from a similar study that showed that 72% of the study respondents had a history of diabetes (El-Khawaga & Abdel-Wahab, 2015). This findings are however brought to question by findings from other studies that showed that 232 (77.3%) and (66.9%) respectively (Berhe et al., 2014; Bano et al., 2014). This thus shows that the cause effect relationship between having a family history of T2DM and having T2DM is yet to be established.

Nutrition knowledge provision is a key pillar in the management of diabetes, a lot of effort has been put in the healthcare system to ensure that every patient diagnosed with diabetes

is given enough information during clinic attendance. This seems to have borne fruit since a significantly high number of respondents in this study (95.4%) had good nutrition knowledge with the mean knowledge level being reported at 82.2%. This continues to be true as seen in other studies concerning the nutrition knowledge levels of persons with T2DM that reported slightly more than half (56.0%) of its study respondents having good nutrition knowledge (Berhe et al., 2014). The significantly higher levels of knowledge our current study may be due to the support the DM clinic in Nakuru level 6 hospital receives from partners such a Novo Nordisk. This stands to underscore the importance of an integrated approach towards T2DM management. The findings of this study however contradict with others that reported thatT2DM patients had poor nutrition knowledge of 49.9% and 81% respectively (Parajuli et al., 2014; Bano et al., 2017). The high nutrition knowledge observed may be attributed to clinic attendance where they are more likely to receive nutrition information on occasional basis.

Consuming food from diverse food groups ensures that an individual gets all the relevant nutrients contained therein. This is particularly important for T2DM patients because of the physiological changes their bodies undergo because of their condition. T2DM patients in Nakuru level 6 Hospital seem to be aware of this fact since a significant number (71.8%) of them were reported to have high dietary diversity scores. This could be easily attributed to the significantly good nutrition knowledge that this patients have. Similar findings were also observed among the group of people, and reported that a simple majority 35.9% of the respondents had good dietary diversity (Demilew et al., 2018). The visibly glaring difference between the reported numbers by both studies despite both being a majority,

only serves to show that a lot more still needs to be done to ensure that all T2DM patients whereever they are receive a similar kind of medical attention.

Dietary modification is a crucial component of T2DM management; this modification is mostly focused towards quantitative manipulation of macronutrients to achieve good glycemic control for T2DM patients. Findings from this study are particularly worrying because starches were consumed and cooking oil used on a daily basis by a majority of the respondents 40.3% and 96.9% respectively. Cooking oil use maybe high due to its role in cooking of food. This is a concern because important macronutrients known for their major contribution of fiber in the diet are only consumed once a week: Vegetables (41.4%), fruits (36.8%), legumes (37.2%), animal products (34.4%), roots, and tubers (33.1%). Sugars and sweets on the other hand were mostly never consumed at (87.3%), this is a positive feedback however it may be concluded that most T2DM patients may be attributing sugar from sweet tasting foods only as the may source of blood glucose and forgetting or may not be aware of the glucose emanating from other carbohydrates. This findings are further reinforced by findings that showed that slightly more than half of the respondents mostly consumed starches (52.9%), and used cooking oil (82.4%) on a daily basis (Wahome et al., 2018). Furthermore, another study also reported animal protein consumption to be less frequently consumed (27.7%), and that vegetable consumption was significantly high (80%) (Ozcariz et al., 2015). These findings clearly show a gap in dietary practices among T2DM patients that ought to be filled.

T2DM is characterized by excessive body weight and obesity and this state is contributed by increased energy consumption as observed in this study, where the mean energy

consumption was reported at 2204 ±433.4 (110%)for male participants and 2170.3±491.0 (121%) for female participants, this exceeded the recommendation for energy intake. This increased energy intake could be attributed to their increased consumption of a high carbohydrate (233%) for male and (230%) for female and protein diet (148%) for male and (177%) for female, despite their contraindication. Consequently, their fat and fiber consumption levels were below the recommended levels: (42%) for male and (41%) for female and fiber (63%) for male and (62%) respectively. This trend is interesting because it would be expected that with the nutrition knowledge level reported there would be a consequent improvement in the patient's choice of food. This would therefore mean that there are also other factors at play. Micronutrients are known for their effect on the pathophysiology of DM, though their role may not be clearly spelt out it is significant, thus significant exploration is required to determine their role in improving the prognosis of people with T2DM. In pursuit of this, the study determine that a majority of the respondents exceeded the adequacy levels for Vitamin A, Magnesium (mg), Phosphorous (mg), Iron, Selenium (µg), Zinc. They however, did not meet the recommended adequacy levels for Vitamin D. This finding could be attributed to the consumption of a varied diet as observed in the T2DM patients DDS.

These findings were contrary to other studies' findings that showed the mean energy as 1919.03 ± 364.70 Kcal and only 25% of their study participants met the RDA. Protein consumption levels were also significantly low 61.67 ± 11.96 g, with only 8.5% of the participants meeting the RDA. Mean dietary fiber intake was (20.09 ± 5.50 g/day) with only 15.2% of the participants meeting the RDA. Micronutrients consumption was below the recommendations, the mean intake being; zinc (mg) (2.55 ± 1.13), and only 26.7% of

participants met the RDA for iron mean consumption being 10.19 ± 6.62. (Miyoba, 2018). This trend is further reinforced by findings from a study done in the US that showed that majority of the study respondents consumed a moderate amount of carbohydrates averaged at approximately 45% of total energy intake (Franz, Boucher & Evert, 2014). Both exceeding and failure to meet the adequacy levels of nutrients is not recommended for T2DM patients and is a clear indication that an intervention strategy is urgently required in order to improve the dietary practices of people with T2DM.

In order to avoid the complications of hypoglycemia and hyperglycemia among T2DM patients, the number of daily meals need to be regulated. T2DM patients on medication are particularly in danger of hypoglycemia if they skip any meal and are therefore required to consume at least 3 meals a day, but preferably more. Positive results are observed from this study where more than half of the respondents 145(55.3%) had three meals daily, a similarly higher number 99(37.8%) of respondents ate >3 a day, this shows that people with T2DM are aware of this fact. This is further supported by a study done by Mbututi et al. (2016) that showed that slightly less than half 39% of the respondents ate at least 7 meals spaced evenly throughout the day.

BMI; in kg/m^2 one of the nutrition assessment parameters is known as risk factor for T2DM and is there for significant parameter to determine and monitor during the management of diabetes. Despite the majority of the respondents having a normal BMI; in kg/m^2 103(39.3%), there was still a significantly higher number of T2DM patients with a combined prevalence of both overweight and obesity 153 (58.4%). These results are in tandem with results from another similar study that showed close to half of their

respondents 184 (48%) were obese, whereas 64 (16%) were overweight and 127 (33%) had normal BMI; in kg/m^2 (Parajuli et al., 2014). Another important biochemical marker of glycemic control was tested and most of the respondents 126 (48.1%), were determine to have poor glycemic control with a significantly high random blood sugar (RBS) level of >11.0 mmol/l (>196 mg/dl), and a mean score of 12.3±6.1 mmol/l (222±110 mg/dl). This was in agreement with other studies that showed that the majority of the respondents (64.7%) had a poor glycemic control (Abebe et al., 2015). Similarly, another study showed that the mean blood sugar level was 174.25±57.14 mg/dl (Fasil et al., 2019). This is further re-enforced by a similar study from Jimma, Ethiopia that found that the average blood sugar levels were 163±45 mg/dl (Angamo, 2013). It can therefore be concluded that generally T2DM patients have poor nutrition status and be attributed to poor dietary choices as evidence by their adequacy levels for nutrients.

According to findings from this study participants' individual income ($P \leq 0.01$), their level of education ($P \leq 0.007$) and Body Mass Index ($P \leq 0.012$) had a significant association with nutrition knowledge. This association was such that, participants with no formal education were more likely to have good nutrition knowledge (AOR: 3.921) as compared to those with a formal education. Similarly, those participants who earn an income of ≥20000 were more likely to have good nutrition knowledge (AOR: 1.274) as compared to those who earn an income of <20000. Similarly, another study also reported a significant association between monthly income ($P \leq 0.001$) and education level ($P < 0.001$) (Berhe et al., 2014). On the contrary, another study reported an increased likelihood of participants' in different categories of education to have good knowledge: Primary (OR=2.6), secondary (OR=3.5), and tertiary (OR=5.6), as compared to those who were illiterate. Furthermore, another

study also reported that participants whose household income were between 501-800 Birr (AOR: 1.56), 801-1450 Birr (AOR: 1.61) and >1450 Birr (AOR: 2.14) were more likely to have good knowledge when compare to those whose household income were <500 Birr (Asmamaw et al., 2015). There is thus a strong likelihood that diabetic patients with no formal education and or low-income levels have poor nutrition knowledge.

Various predictors of dietary diversity identified by this study include participants' household income (P≤0.018) and BMI; in kg/m^2 (P≤0.022). Whereby, respondents earning a slightly higher income ≥20000 are more likely to have a good dietary diversity (AOR: 1.325). Similarly, those who were malnourished are more likely to have a good dietary diversity (AOR: 1.021). This is further confirmed by findings from a similar study that reported a significant association between participants' income and dietary diversity ($p<0.01$), and that participants with higher income had high dietary diversity as compared to those with limited income (Begum et al., 2004). This is further reinforced by another study that showed that having a high income was associated with better access to healthy more diverse diet (Breland et al., 2013). Improving patients' income levels would therefore significantly improve their dietary practices.

Finally, it is common knowledge that consumption of carbohydrates or fiber has an effect on T2DM patients' glycemic control, albeit in different directions. This fact is confirmed by the findings of this study that reported a significant association between T2DM patients RBS with the participant's age (P≤0.043), carbohydrate (P≤0.034) and fiber consumption (P≤0.016). BMI; in kg/m^2 also had a significant association with the respondent's DDS (P≤0.001) and Daily energy consumption (P≤0.006). These findings confirm the fact that

energy consumption levels have a direct bearing on the nutrition status of people with T2DM. Findings from this study further showed that participants who were younger <45 years were more likely to have a good glycemic control (AOR: 1.319) as compared to their older counterparts. Further research is required to determine the role of age in glycemic control and if there are other factors that come into play as one grows older that may interfere with glycemic control. Another study further reinforces this findings by reporting a significant association (P≤0.004) between participants age in years and glycemic control; older participants (≥65 years) were however less likely to have good glycemic control (AOR: 0.070) (Fasil, et al., 2019). There was also a significant association (P<0.001) between higher dietary diversity with obesity, with the odds of obesity also increased with an increase in DDS (OR: 1.46; 95% CI: 1.22, 1.74). On the other hand, foods with high fiber content were significantly associated (P<0.001) with glycemic control (Karimbeiki et al., 2018). Another study on the contrary, showed no significant association (P≤0.96) between patients glycemic control and carbohydrate intake, neither was there a significant association between their BMI; in kg/m^2 and energy consumed (P≤0.53) (Tay et al., 2020).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This section contains the summary of findings, conclusion based on the findings and recommendations

5.2 Summary of Findings

5.2.1 Demographic Characteristics of T2DM Patients

Results from this study reported that majority of the T2DM respondents were: Male- (58.8%), Aged 41- 50 (35.9%), Married (79.8%), Christian (96.2%), live in urban areas of Nakuru (71.4%), and have had DM for ≤ 5 (52.7%).

5.2.2 Socio-Economic Characteristics of T2DM Patients

This study reported that majority of the respondents: Had ≤3 HH members (53.4%), had Secondary school level of education (42.7%), earned income through Business related activities (31.7%), their household income levels were between Ksh 10001-20000 (31.3%), and had family history of DM (59.9%).

5.2.3 Nutrition Knowledge of T2DM Patients

Most of the T2DM patients who participated in the study had good nutrition knowledge 250 (95.4%)

5.2.4 Dietary Practices of T2DM Patients

Majority of T2DM patients have a high dietary diversity score 188(71.8%). They consumed starches (40.3%) and used cooking oil (96.9%) on a daily basis, however, they consumed vegetables (41.4%), and most never consumed sugars and sweets (87.3%)

Majority of the study respondents: exceeded the adequacy levels for Energy: male (110%) and female (121%) Carbohydrates (233%) for male, and (230%) for female and Proteins (148%) for male and (177%) for female. They however did not meet the adequacy levels for Fat (42%) for male, and (41%) for female and Fiber (63%) for male and (62%) for female.

5.2.5 Nutrition Status of T2DM Patients

Majority of the respondents had a normal BMI; in kg/m^2 103(39.3%), however, Most 126(48.1%), still had RBS level of >11.0 mmol/l

5.2.6 Association between Demographic and Socio-Economic Characteristics, Nutrition Knowledge, Dietary Practices and Nutrition Status of T2DM Patients

The study's participants individual income ($P \leq 0.01$), level of education ($P \leq 0.007$) and BMI; in kg/m^2 ($P \leq 0.012$) had a significant association with nutrition knowledge. Whereas Household income ($P \leq 0.018$) and BMI; in kg/m^2 ($P \leq 0.022$) had a significant association with dietary diversity. Their random blood sugar levels had a significant association with the participant's carbohydrate ($P \leq 0.034$) and Fiber consumption ($P \leq 0.016$). BMI; in kg/m^2 also had a significant association with the respondent's DDS ($P \leq 0.001$) and Daily energy consumption ($P \leq 0.006$).

Participants with no formal education were more likely to have good nutrition knowledge (AOR: 3.921) as compared to those with a formal education. Similarly, those participants who earn an income of ≥20000 were more likely to have good nutrition knowledge (AOR: 1.274) as compared to those who earn an income of <20000. Finally, participants who were younger <45 years were more likely to have a good glycemic control (AOR: 1.319) as compared to their older counterparts.

5.3 Conclusion

i. Most T2DM patients are males, aged between 41-50 years, married and have at least basic level of education. Mostly, T2DM patients depended on business as their main source of income. However, most earn a household income of <20000 Ksh a month.

ii. Most T2DM patients have high level of nutrition knowledge. However, majority of the participants do not know the causes of T2DM and think that eating food high in sugar causes diabetes

iii. Most T2DM patients consume a highly diverse diet, they however consume carbohydrates and fats more frequently, and exceeded their adequacy levels in carbohydrates and proteins, but however, do not meet the adequacy levels for fats and fiber.

iv. Majority of T2DM patients have a normal BMI; in kg/m^2. However, their combined prevalence of both overweight and obesity is even higher. They also have poor glycemic control.

v. There is a significant association between respondents' nutrition knowledge and their individual income, level of education and BMI; in kg/m^2. Their household

income and BMI; in kg/m^2 also has a significant association with their dietary diversity. Their random blood sugar however, has no significant association with level of education or BMI; in kg/m^2.

vi. T2DM patients are less likely to have a high DDS if they are educated, had a good income or had good nutrition knowledge. However, they are more likely to have good nutrition knowledge if they are more educated or have a good income. Also, by eating a varied diet T2DM patients are more likely to have a good nutrition status

5.4 Recommendations

i. Information provided at the diabetic clinic should be emphasize more on proper dietary practices since they exceed adequacy levels for carbohydrates and protein

ii. Weight loss strategies for T2DM patients should be encouraged since the prevalence of overweight and obesity is significant higher that those with normal BMI; in kg/m^2

iii. Emphasis and training on close monitoring of blood sugar levels by T2DM patients at home.

5.4.1 Policy recommendations

i. The County's Health Department should consider rolling out fully funded diabetic clinics across all health care centers across the county

5.4.2 Recommendations for further research

The study recommends further research to determine:

i. The effect of T2DM patients' income, education and BMI; in kg/m^2 on both nutrition knowledge and dietary diversity

ii. Why being male, being of ages of 41-50 and earning a low income are risk factor for diabetes.

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APPENDICES

Appendix 1: Consent form

PARTICIPANT INFORMATION AND CONSENT FORM FOR ENROLLMENT IN THE STUDY

Introduction
Title of Study: Knowledge, dietary practices, and nutrition status of T2DM patients at Nakuru Level 6 Hospital

Principal Investigator\and institutional affiliation: Dominic Kiprotich, Kabarak University

Co-Investigators and institutional affiliation:
_____

Introduction:

My name is Dominic Kiprotich, a postgraduate student at Kabarak University, Kenya pursuing Master of Science in Human Nutrition and Dietetics. I would like to tell you about a study on Knowledge, attitude, practices, and nutrition status (anthropometrics and glucose levels) among diabetic patients at Nakuru Level 6 Hospital, Kenya being conducted by the above listed researcher.

The purpose of this consent form is to give you the information you will need to help you decide whether or not to be a participant in the study. Feel free to ask any questions about the purpose of the research, what happens if you participate in the study, the possible risks and benefits, your rights as a volunteer, and anything else about the research or this form that is not clear. When we have answered all your questions to your satisfaction, you may decide to be in the study or not. This process is called 'informed consent'. Once you understand and agree to be in the study, I will request you to sign your name on this form. You should understand the general principles which apply to all participants in a medical research: i) Your decision to participate is entirely voluntary ii) You may withdraw from the study at any time without necessarily giving a reason for your withdrawal iii) Refusal to participate in the research will not affect the services you are entitled to in this health facility or other facilities. We will give you a copy of this form for your records.

May I continue?

- ☐ **YES**
- ☐ **NO**

This study has approval by Kabarak University Ethics and Research Committee protocol No. _____

Study procedures

The focus of this study is T2DM patients above 18 years attending diabetic clinic at Nakuru level five Hospital. The findings of this study may help identify gaps in the hospital diet; food service delivery and nutrition care in general so that corrective action is taken.

I and my four research assistants will ask you questions on; 1) demographic, education and socio-economic characteristics, 2) Your knowledge concerning diabetes 3) Your attitude towards diabetes 3) Your dietary practices 4) Other addition information related to dietary practice including nutritional status (glycemic control and BMI). Your weight and height will be determined and will be used to measure your body mass index, your glucose levels will be determined using Random Blood Sugar levels or Fasting Blood Sugar levels taken by the nurse during your diabetic clinic visit.

Benefits

The findings of this study may help identify gaps knowledge, attitude and dietary practices of diabetic patients. The results of this research may also provide more inform on the knowledge, attitude, dietary practice and nutritional status of T2DM patients at Nakuru level 6 Hospital. This may contribute towards improving nutrition care quality in the Kenya health care system in particularly the Kenyan public hospitals

Risks

Medical research has the potential to introduce psychological, social, emotional and physical risks. However, this research does not involve any invasive procedures and therefore may pose no physical risk. One potential risk of being in the study however, is loss of privacy. We will keep everything you tell us as confidential as possible. We will use a code number to identify you in a password-protected computer database and will keep all of our paper records in a locked file cabinet. However, no system of protecting your confidentiality can be absolutely secure, so it is still possible that someone could find out you were in this study and could find out information about you.

Also, answering questions in the interview may be uncomfortable for you. If there are any questions you do not want to answer, you can skip them. You have the right to refuse the interview or any questions asked during the interview.

It may be embarrassing or stressful for you to disclose or discuss any personal, dietary or diagnostic information. We will do everything we can to ensure that this is done in private. Furthermore, all study staff and interviewers are professionals with special training in conducting nutrition assessments and interviews.

You may feel some discomfort when being assessed. In case of an injury, illness or complications related to this study, contact the study staff right away at the number

provided at the end of this document. The study staff will attend to you or refer you when necessary.

Rights

Participation in this research is voluntary. You are at liberty not to participate in this study and non-participation will not interfere with hospital service delivery. During the course of the interview, you are free to decline to answer any question you don't want to or are uncomfortable with. In that case, we can skip that question and proceed to other questions. You are also free to end the interview any time you feel like. However, we encourage you to participate fully as the information collected will benefit the patients as well as provide valuable information to hospitals.

Confidentiality

We will keep everything you tell us as confidential as possible. Whatever information you provide will be kept in confidence and will not be shared with any other persons other than my supervisors. Your identity will be withheld and the results of the study will not make any mention of a particular participant. We will use a code number to identify you in a password-protected computer database and will keep all of our paper records in a locked file cabinet. However, no system of protecting your confidentiality can be absolutely secure, so it is still possible that someone could find out you were in this study and could find out information about you.

Compensation

This study does not offer any payments to the patients. However, we would very much appreciate your participation in this research since your views are important.

Complaints and/or queries

This study has been approved by Nakuru Provincial General Hospital administration and granted ethical clearance by Kabarak Ethics and Research Committee at Kabarak University. In case of any complaints and/or queries regarding this study, kindly contact the following persons:

1. The Vice Chancellor
   Kabarak University
   Private Bag- 20157,
   Kabarak.

2. Dominic Kiprotich
   Kabarak University
   Private Bag- 20157,
   Kabarak.
   Principal-Investigator
   Mobile: 0724113405

Appendix 2: Consent statement

CONSENT FORM (STATEMENT OF CONSENT)

Participant's statement

I have been duly informed about the nature and purpose of the research and the researcher has also mentioned the benefits of conducting the study. It is evident that there are no invasive procedures in this study and hence no risks associated with it. The information provided in this research may help to improve hospital diets, nutrition care and enhance diet satisfaction of patients. I have been assured of confidentiality on any information that will be shared. Participation in this study is voluntary and I have willingly accepted to participate in the research.

Participants Name: ……

Signature or thumb print of Interviewee: …….

Date: ……

Researcher's statement

I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and has willingly and freely given his/her consent.

Researcher's Name: _____ **Date**: _____

Signature _____ **Role in the study**: _____For more information contact _____at _____from _____to _____

Witness Printed Name (*If witness is necessary, A witness is a person mutually acceptable to both the researcher and participant*)

Name _____ Contact information _____

Signature /Thumb stamp: _____ Date; _____

Appendix 3: Questionnaire

NUTRITION KNOWLEDGE, DIETARY PRACTICES AND NUTRITION STATUS OF TYPE 2 DIABETIC PATIENTS ATTENDING DIABETIC CLINIC AT NAKURU LEVEL 6 HOSPITAL, KENYA

Specific Objectives

1. To assess the demographic and socio-economic characteristics of T2DM patients attending diabetic clinic at Nakuru level 6 Hospital
2. To establish the level of nutrition knowledge of diabetes management among T2DM patients attending diabetic clinic at Nakuru Level 6 Hospital
3. To assess the dietary practices among T2DM patients at Nakuru Level 6 Hospital
4. To assess the nutrition status of T2DM patients attending diabetic clinic at Nakuru Level 6 Hospital
5. To determine the association between demographic and socio-economic characteristics, nutrition knowledge, dietary practice and nutrition status of T2DM patients attending diabetic clinic at Nakuru Level 6 Hospital

Contacts	Name	Telephone	Email
Study PI	Dominic Kiprotich	+254724113405	dominickiprotich4@gmail.com
Supervisor	Dr. Peter Chege	+254722642356	chegepetem@gmail.com
Supervisor	Dr. Dorothy Mituki	+254722333133	dotmituki@yahoo.com

Kabarak University, School of Medicine and Health Sciences, Private Bag- 20157, Kabarak

Questionnaire Code No.	____ ____ ____
Date of the interview	d d m m y y y y
Participant initials	____ ____ ____
Hospital Name	
Clinic	
Start time	H H M M
End time	H H M M
Name of interviewer (Initials)	____ ____ ____
Checked by (Initials)	____ ____ ____

A. Demographic Information

1.	Gender of the interviewee	☐ Male ☐ Female
2.	Interviewee's age in years	☐☐ years ☐Unknown
3.	Marital status	☐Single ☐Married ☐Separated ☐Divorced ☐Other (Specify) _____
4.	Religion	☐ Christian ☐ Muslim ☐ Hindu ☐ Not Religious ☐ Others (Specify)_____ _____
5.	Area (Sub-County) of Origin	☐ Nakuru East ☐ Nakuru West ☐ Nakuru North ☐ Subukia ☐ Naivasha ☐ Gilgil ☐ Molo ☐ Njoro ☐ Kuresoi North ☐ Kuresoi South ☐ Rongai ☐ Others Specify_____
6.	Duration with diabetes (Years)	
7.	Age of diabetes diagnosis	
8.	Source of diabetes management knowledge	☐ During inpatient admission ☐ Diabetic clinic ☐ During visit to the doctor ☐ Other diabetic patients ☐ Primary School ☐ Secondary School ☐ Tertiary Institution ☐ Others Specify_____

9.	Family history of diabetes	☐ Yes ☐ No
10.	Do you practice dietary management?	☐ Yes ☐ No
11.	What do you think motivates you to practice proper dietary management?	☐ Proper nutrition counselling ☐ Need to maintain good glycemic control ☐ Family support ☐ Ability to always afford food ☐ Availability of time to prepare a balanced diet ☐ Great accessibility to the grocery market
12.	What do you think demotivates you about practicing proper dietary management?	☐ Not getting nutrition counselling ☐ Lack of family support ☐ Inability to always afford food ☐ Not getting time to prepare a balanced diet ☐ Inaccessibility of the grocery markets
13.	Dietary management of diabetes is effective in controlling blood glucose levels	☐ Strongly agree (1) ☐ Agree (2) ☐ Neutral (3) ☐ Disagree (4) ☐ Strongly disagree (5)
14.	It is possible to manage diabetes using diet	☐ Strongly agree (1) ☐ Agree (2) ☐ Neutral (3) ☐ Disagree (4) ☐ Strongly disagree (5)
15.	I take diabetes medication (Insulin/Diabinose)	☐ Yes ☐ No
16.	I find it difficult adhering to diabetes medication	☐ Yes ☐ No

B. Education and socio-economic characteristics

17.	What is your highest level of education?	☐ Never went to school/ No formal education ☐ Kindergarten ☐ Partial primary ☐ Completed primary ☐ Partial secondary ☐ Completed Secondary ☐ Incomplete College/University/Tertiary ☐ Completed College/University/Tertiary
18.	What is your primary source of income?	☐ Farmer ☐ Business/trader ☐ Casual Labourer ☐ Domestic work ☐ Private sector employment ☐ Public sector employment ☐ Retired with pension ☐ Other (Specify)_____ ☐ N/A *(no work income)*
19.	number of your household members?	☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ Others, specify_____
20.	What is you estimated average income per month?	
21.	What is you estimated average household income per month?	

22.	How much do you approximately spend on food per week in your HH?	

C. Nutrition Assessment

23. Weight	Measurer 1	__ __ __ Kg	24. Height	Measurer 1	__ __ __ cms
	Measurer 2	__ __ __Kg		Measurer 2	__ __ __ cms
	Measurer 3	__ __ __Kg		Measurer 3	__ __ __cms
	Averag e	__ __ __Kg		Averag e	__ __ __cms
25. BMI; in kg/m^2	__ __ . __				
26. Waist Circumfere nce (cm)	— — —. —				
27. Random Blood Sugar	__ __.__ mmol/l				

D. Nutrition Knowledge

S/NO	QUESTION	YES	NO
28.	Diabetes is an infectious disease		
29.	Eating too much sugar causes diabetes		
30.	A diabetic individual should reduce carbohydrates intake		
31.	Consumption of green leafy vegetable is encouraged for person diagnosed with diabetes		

S/NO	QUESTION	YES	NO
32.	Small frequent meals are encouraged for a person with diabetes		
33.	Missing a meal has no effect on a person with diabetes		
34.	Dietary management is not necessary If a person with diabetes takes medication as prescribed by a doctor		
35.	It is alright to skip diabetes medication once is a while		
36.	Dietary intervention is important in managing diabetes		
37.	Infections (i.e. Flu) has no effect on blood sugar levels		
38.	Seeking immediate medical attention in case of an infection is necessary for a diabetic patient		
39.	One can indulge in high carbohydrate diet once in a while without it affecting the blood sugar levels		
40.	Intake of sweets or carbohydrate snacks is not encouraged as an emergency measure in managing hypoglycemia		
41.	A diabetic diet is one with High carbohydrates, High protein and Low Fiber		
42.	Consuming alcohol has no effect on the sugar levels of a diabetic person		
43.	Life style modification is important once you are diagnosed with diabetes		
44.	Exercise of more than 30 minutes is important in managing diabetes		
45.	Obesity is a risk factor for diabetes		
46.	Being of younger age <45 age is a risk factor for diabetes		
47.	Cardio-Vascular diseases can result from uncontrolled diabetes		
48.	Retinopathy and Neuropathy are consequences of uncontrolled diabetes		

E. Dietary Diversity

	Food group	Example	
49.	CEREALS	corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + insert local foods e.g. ugali, nshima, porridge or paste	☐ Yes ☐ No
50.	WHITE ROOTS AND TUBERS	white potatoes, white yam, white cassava, or other foods made from roots	☐ Yes ☐ No
51.	VITAMIN A RICH VEGETABLES AND TUBERS	pumpkin, carrot, squash, or sweet potato that are orange inside + other locally available vitamin A rich vegetables (e.g. red sweet pepper)	☐ Yes ☐ No
52.	DARK GREEN LEAFY VEGETABLES	dark green leafy vegetables, including wild forms + locally available vitamin A rich leaves such as amaranth, cassava leaves, kale, spinach	☐ Yes ☐ No
53.	OTHER VEGETABLES	other vegetables (e.g. tomato, onion, eggplant) + other locally available vegetables	☐ Yes ☐ No
54.	VITAMIN A RICH FRUITS	ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + other locally available vitamin A rich fruits	☐ Yes ☐ No
55.	OTHER FRUITS	other fruits, including wild fruits and 100% fruit juice made from these	☐ Yes ☐ No
56.	ORGAN MEAT	liver, kidney, heart or other organ meats or blood-based foods	☐ Yes ☐ No
57.	FLESH MEATS	beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects	☐ Yes ☐ No
58.	EGGS	eggs from chicken, duck, guinea fowl or any other egg	☐ Yes ☐ No
59.	FISH AND SEAFOOD	fresh or dried fish or shellfish	☐ Yes ☐ No
60.	LEGUMES, NUTS AND SEEDS	dried beans, dried peas, lentils, nuts, seeds or foods made from these (eg. hummus, peanut butter)	☐ Yes ☐ No

	Food group	Example	
61.	MILK AND MILK PRODUCTS	milk, cheese, yogurt or other milk products	☐ Yes ☐ No
62.	OILS AND FATS	oil, fats or butter added to food or used for cooking	☐ Yes ☐ No
63.	SWEETS	sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes	☐ Yes ☐ No
64.	SPICES, CONDIMENTS, BEVERAGES	spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages	☐ Yes ☐ No
65.	Did you eat anything (meal or snack) OUTSIDE the home yesterday?		☐ Yes ☐ No

F. Food frequency

	Type of food	Every day (0)	Once a week (1)	Twice a week (2)	Once a month (3)	Season ally (4)	Never consumed (5)
	Vegetables						
66.	Spinach						
67.	Pumpkin leaves						
68.	Carrots						
69.	Tomatoes						
70.	Cabbage						
71.	Kales						
Fruits							
72.	Ripe bananas						
73.	Oranges						

	Type of food	Every day (0)	Once a week (1)	Twice a week (2)	Once a month (3)	Season ally (4)	Never consumed (5)
74.	Pineapple						
75.	Mangoes						
Pulses and legumes							
76.	Beans						
77.	Ndengu						
78.	Lentils						
Animal products							
79.	Beef						
80.	Poultry						
81.	Fish						
82.	Milk						
Cereals and cereal products							
83.	Ugali						
84.	Chapati						
85.	Maize						
86.	Whole meal bread						
Roots and tubers							
87.	Sweet potatoes						
88.	Irish potatoes						
89.	Arrowroot						
	Fats and oils						
90.	Margarine						
91.	Cooking oils						
Sugar and honey							
92.	Cake						
93.	Biscuits						

	Type of food	Every day (0)	Once a week (1)	Twice a week (2)	Once a month (3)	Season ally (4)	Never consumed (5)
94.	Honey						

G. Meal consumption frequency

		One	Two	Three	Four	Five	Six
95.	How many meals do you consume in a day						

H. 24 Hour Recall

	Name of Food	Food description	Household Amount	Amount (g/mL)	Preparation/ ingredients
Breakfast					
Snack					
Lunch					
Snack					

	Name of Food	Food description	Household Amount	Amount (g/mL)	Preparation/ ingredients
Supper					
Others Specify					

Appendix 4: Study approval by KUREC

KABARAK UNIVERSITY RESEARCH ETHICS COMMITTEE

Private Bag - 20157
KABARAK, KENYA
Email: kurec@kabarak.ac.ke

Tel: 254-51-343234/5
Fax: 254-051-343529
www.kabarak.ac.ke

OUR REF: KABU01/KUREC/001/06/05/21

3rd June, 2021

Dominic Kiprotich.
Kabarak University,

Dear Dominic.

SUBJECT: ETHICS REVIEW DECISION

Kabarak University Research Ethics Committee (KUREC) received application for a protocol titled "NUTRITION KNOWLEDGE, DIETARY PRACTICES AND NUTRITION STATUS OF TYPE 2 DIABETIC PATIENTS AT NAKURU LEVEL 5 HOSPITAL, KENYA" on 08th April, 2021. The protocol was reviewed and discussed during a virtual meeting held on 3rd May, 2021 at 1000 Hours. The committee considered the application in accordance with the Kabarak University procedures on review of research protocols for ethical clearance and decided as follows:

1. **PROPOSED STUDY SITE**

   Nakuru Level 5 hospital, Kenya

2. **KUREC DECISION**

   Approved for data collection for a minimum period of ONE year from 3rd June, 2021

This approval is subject to the following conditions:

i. The researcher shall obtain a RESEARCH PERMIT from NACOSTI before commencement of data collection & submit a copy to the Kabarak University Institute of Postgraduate Studies (IPGS);
ii. The researcher shall immediately notify KUREC in case of any adjustments to the protocol;
iii. The researcher shall within 7 days of occurrence notify KUREC of any adverse events associated with the conduct of this study;
iv. The researcher shall apply for extension of the study period should the initial 1 year expire before completion of data collection;
v. The researcher shall submit study progress reports to KUREC after every 6 months and a full report at completion of the study/project

Thank you.
Sincerely,

Prof. Jackson Kitetu PhD.

Appendix 5: Research License by NACOSTI

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR
SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 647456

Date of Issue: 02/July/2021

RESEARCH LICENSE

This is to Certify that Mr.. Dominic Kiprotich Kiprotich of Kabarak University, has been licensed to conduct research in Nakuru on the topic: NUTRITION KNOWLEDGE, DIETARY PRACTICES AND NUTRITION STATUS OF TYPE 2 DIABETIC PATIENTS AT NAKURU LEVEL 5 HOSPITAL, KENYA for the period ending : 02/July/2022.

License No: NACOSTI/P/21/11385

647456

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR
SCIENCE,TECHNOLOGY &
INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

GOVERNOR
NAKURU COUNTY
06 JUL 2021
RECEIVED

Appendix 6: Study authorization by the County Commissioner

OFFICE OF THE PRESIDENT
Ministry of Interior and Coordination of National Government

Email: cnakurucounty@yahoo.com
cnakurucounty@gmail.com

When replying please quote:

COUNTY COMMISSIONER
NAKURU COUNTY
P.O. BOX 81
NAKURU

Ref No. CC. SR. EDU 12/1/2/VOL.V1/28

6th July, 2021

Deputy County Commissioner
NAKURU WEST

RE: RESEARCH AUTHORIZATION – MR. DOMINIC KIPROTICH

The above named from Kabarak University has been authorized to carry out research on **Nutrition Knowledge, Dietary Practices and Nutrition Status of Type 2 Diabetic Patients** at Nakuru Level 5 Hospital, in Nakuru County for a period ending 2nd July 2021.

Please accord him all the necessary support to facilitate the success of his research.

ANDERSON AYUKU
FOR: COUNTY COMMISSIONER
NAKURU COUNTY

Appendix 7: Study authorization by the Ministry of Education

MINISTRY OF EDUCATION

State Department of Basic Education

Telegrams: "EDUCATION",
Telephone: 051-2216917
Fax: 051-2217308
Email: cdenakurucounty@gmail.com
When replying please quote

COUNTY DIRECTOR OF EDUCATION
NAKURU COUNTY
P. O. BOX 259,
NAKURU.

Ref. NO. CDE/NKU/GEN/4/1/21/VOL.VII/115

6th July, 2021

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORIZATION – DOMINIC KIPROTICH NACOSTI/P/21/11385

Reference is made to the above-mentioned permit dated 2nd July, 2021

Authority is hereby granted to the above-named individual to carry out research on "***Nutrition Knowledge, Dietary Practices and Nutrition Status of Type 2 Diabetic Patients at Nakuru Level 5 Hospital, Kenya***" for the period ending 2nd July, 2022.

Kindly accord him necessary assistance.

COUNTY DIRECTOR OF EDUCATION
NAKURU COUNTY
P. O. Box 259 NAKURU

RUTH KAMAU
FOR: COUNTY DIRECTOR OF EDUCATION
NAKURU

Copy to:

- Kabarak University

Appendix 8: Study authorization by County Director of Public Health

DEPARTMENT OF HEALTH SERVICES

NAKURU COUNTY

COUNTY DIRECTOR PUBLIC HEALTH
NAKURU COUNTY
P O BOX 2600-20100
NAKURU

Ref No. NCG/CDMS/GEN VOL 1/356

22nd July, 2021

TO
MEDICAL SUPERITENDENT
NAKURU LEVEL 5 HOSPITAL

RE: RESEARCH AUTHORISATION
DOMINIC KIPROTICH KIPROTICH

This letter serves as an authorization from the County Department of Health Services Nakuru for the above named student from Kabarak University to carry out research at Nakuru Level 5 Hospital.

The research title is ***"NUTRITION KNOWLEDGE, DIETARY PRACTICES AND NUTRITION STATUS OF TYPE 2 DIABETIC PATIENTS AT NAKURU LEVEL 5 HOSPITAL".***

Kindly accord him the necessary support.

Thank you.

COUNTY DIRECTOR
PUBLIC HEALTH & SANITATION
NAKURU COUNTY
P.O. Box 2060-20100,
NAKURU

Appendix 9: Study permit by Nakuru Level 6 Hospital

REPUBLIC OF KENYA
NAKURU COUNTY GOVERNMENT
DEPARTMENT OF HEALTH SERVICES

NAKURU COUNTY

Email:rvpghnakuru@yahoo.com
Mobile: +254721750460

NAKURU PROVINCIAL GENERAL HOSPITAL
P.O. BOX 71-20100
NAKURU

When replying please quote:

REF: R&EC/PGH/NKU/VOLI/2021 **30th July 2021**

RE: PREAUTHORIZATION GUIDELINES

I **DOMINIC KIPROTICH** from Kabarak University agree to adhere to the laid down procedures of the institution as I undertake my study here.

QUESTIONEER (AREA OF STUDY)

"NUTRITION KNOWLEDGE DIETARY PRACTICES AND NUTRITION STATUS OF TYPE 2 DIEBETIC PATIENTS AT NAKURU LEVEL 5 HOSPITAL"

Upon finishing the study, I will submit a hard and soft copy of my findings to the institution.

Signed..... **Date**....27/7/2021.....
ID. NO/Passport ..26877493.....
Institution...Kabarak University.....
Contacts ...0724183405 / kipdominic@kabarak.ac.ke.....

Chairperson Joseph Kosgei **Sign**..... **Date**.30/7/2021

SUPERINTENDENT - NAKURU LEVEL 5 HOSPITAL
P O Box 71 - 20100 NAKURU
30 JUL 2021
Sign