

**WEIGHT STATUS AND DIETARY PATTERNS OF TYPE 2 DIABETIC PATIENTS
AGED 20-65 YEARS IN JINJA REGIONAL REFERRAL HOSPITAL**

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**A RESEARCH REPORT SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENTS OF THE AWARD OF THE DEGREE OF BACHELOR OF SCIENCE IN
HUMAN NUTRITION OF MAKERERE UNIVERSITY.**

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2019

DECLARATION

I KIA IMELDA declare that this report is original and has never been submitted to any Institution of learning for any reward.

Sign 

Date 14/08/19

APPROVAL

This is to certify that this research was done under my supervision as an academic supervisor and was submitted with my approval.

Signature 

Date 14/08/2019

PROFESSOR CHARLES MUYANJA

DEDICATION

I would like to dedicate this report to my family and friends for their continued support that I have received from them. My research supervisor Professor Charles Muyanja for creating time in his busy schedule to guide me. All the staff of Jinja Regional Referral Hospital for giving me support and helping during the data collection.

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This course unit has been a challenging yet wonderful experience for me. I have achieved a great amount of knowledge in the field of research.

With this I would like to send my sincere gratitude to the following:

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ABSTRACT

Background: Type 2 diabetes mellitus, a disease previously known for "the rich", has become a health problem affecting both the rich and poor. The disease has increasingly become prevalent in adults and the elderly. Diabetes mellitus is a medical complication characterized by an elevation of blood glucose level. The increasing prevalence of T2DM has not been counteracted with enough sensitization about the dietary management of disease. This study aimed at identifying dietary patterns of type 2 diabetic patients in Jinja Regional Referral Hospital (JRRH).

Methodology: The study was carried out at JRRH and the study population consisted of adults (20 years to 65 years) with a sample size of 105 participants. Purposive sampling was used and data collected using anthropometry, questionnaires and 24 hour recall. Nutrition status (BMI), food groups consumed and relationship between diabetes and obesity were determined. Data was analyzed using SPSS version 16.0.

Results: Results showed that the majority of the participants were female (58.1%) and most of the participants had basic education. The results showed that 48.6% of the participants were overweight and 20% obese. Only 25% of the participants had normal BMI whereas 5.7% were underweight. Majority of the people (98.1%) were not engaged in smoking and alcohol consumption. There was no significant relationship ($P>0.05$) between T2DM and the study variables of BMI, dietary intake, smoking and alcohol consumption. However, Cross tabulation between marital statuses, nature of work of the participants and type 2 diabetes mellitus showed significant relationship with p-values of 0.46 and 0.009 respectively.

Conclusion:

The findings of this study have revealed that majority of the participants had three meals per day, however the energy intake was low (52.8%, 1800Kcal). The most consumed food groups were cereals and legumes. Fruit consumption among these patients was very low. There was no relationship between almost all the study variables and type 2 diabetes mellitus. There was high consumption of high energy foods such as cereals and plantain. The consumption of high energy foods poses high risks of obesity and the possible outcomes like type 2 diabetes. There is more need for sensitization on dietary intake and further investigation on dietary patterns of diabetic patients.

LIST OF ACRONYMS

- WHO World Health Organization
- ADA American Diabetic Association
- UDA Uganda Diabetic Association
- IDF International Diabetes Federation
- T2DM Type two Diabetes Mellitus
- UDHS Uganda Demographic Health Survey
- DPP Diabetes Prevention Programme
- BMI Body Mass Index
- RDA Recommended Dietary Allowance
- SDA Seventh Day Adventist
- UBOS Uganda Bureau of Statistics
- NCDs Non Communicable Diseases
- NGOs Non Governmental Organizations

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Diabetes mellitus is a major pandemic disease globally with both high morbidity and mortality and a high health cost to individual patients, their families, and countries, especially in the developing world. Type 2 diabetes is on the rise in both adults and young populations with a projection of a 1.5 times rise in 2030 from the 285 million in 2010 in adults above 20 years of age worldwide (K. Ogurtsova et al). Most (69%) of the increase in type 2 diabetes is anticipated to occur in low-income countries, which will present a great burden to the already constrained health systems of these countries.

In 2017, The International Diabetes Federation reported Uganda to have a prevalence of diabetes in adults to be 15%. Uganda is one of the 32 countries of the IDF African region. 425 million people have diabetes in the world and more than 16 million people in the AFR Region; by 2045 it will be around 41 million. There were 259,100 cases of diabetes in Uganda in 2017.

In 2015, it was estimated that there were 408 million people with type 2 diabetes in the world. This accounted for about 90% of diabetes cases. Diabetes is common both in the developed and the developing world. The five countries with the greatest number of people with diabetes as of 2014 are India having 31.7 million, China 20.8 million, the United States 17.7 million, Indonesia 8.4 million, and Japan 6.8 million. It is recognized as a global epidemic by the World Health Organization (WHO, 2015). Prevalence estimates for diabetes have varied from 0.4% in cross-sectional surveys around the shores of Lake Victoria to 8.1% in towns close to the city of Kampala and 9.0% in foothills of Rwenzori Mountains in Western Uganda (Bahendeka & Wesonga, 2016).

Diabetes mellitus is a medical complication characterized by an elevation of blood glucose levels. Hyperglycemia is the hallmark sign of type 2 diabetes mellitus, and this is a condition where glucose levels in blood abnormally high (Kaku, et al., 2010).

Personal lifestyle measures to reduce risk of type 2 diabetes have been suggested according to a number of research (Stickler & Siegel, 2011). They include: Healthy diets, physical activity and

regular monitoring of health parameters (body weight, blood sugar, blood pressure, blood lipids, and adherence to therapy (Booth, et al., 2013). Others are cessation of smoking and harmful alcohol intake (Stuckler& Siegel, 2011).

The American Diabetic Association reported that there has been an increase in fat consumption, especially saturated fat intake, while there has been a reduced intake of fiber over the years. It was also found out that only a few of the adults achieved the recommended intake of fruits, vegetables and grains. As a consequence of these changing dietary habits, the prevalence type 2 diabetes mellitus has increased over the past years (ADA, 2008).

Type 2 diabetes is a condition in which the body either does not produce enough insulin or its cells fail to recognize the insulin available in blood circulation hence accumulation of blood sugar.

It is also described as the most common form of diabetes mellitus, caused by a deficiency of the pancreatic hormone insulin required for cellular uptake and metabolism of glucose. Failure to metabolize sugars and starch causing glucose accumulation in the blood and urine of the patient.

Type 2 diabetes mellitus is one of the Non-communicable diseases which have increasingly become a health threat globally (Rowley, et al., 2017). A survey carried out in Uganda, by the ministry of Health entitled rapid assessment of morbidity due to Non-Communicable diseases showed that type 2 diabetes mellitus accounts for 25% of the NCD related deaths in Uganda (Maher, Waswa, & Baisley, 2011).

Type 2 diabetes mellitus a disease previously known for "the rich", has become a health problem affecting both the rich and poor. The disease has increasingly become prevalent in adults and the elderly. Decades of research have shown that much of the burden of chronic diseases is attributable to multiple lifestyle factors working collectively. Proximate risk factors for type 2 diabetes include obesity, family history, insufficient physical activity, raised cholesterol, tobacco use, harmful use of alcohol and unhealthy diets (Eriksson, van den Donk, Hilding, & Ostenson, 2013).

Type 2 diabetes mellitus leads to a number of complications amongst the patients. (International Diabetes Federation, 2013). Over time diabetes can damage the heart, blood vessels, eyes,

kidneys and nerves, and increase the risk of heart disease and stroke. Such damage can result in reduced blood flow, which combined with nerve damage (neuropathy) in the feet hence increases the chance of foot ulcers, infection and the eventual need for limb amputation.

Diabetic retinopathy is an important cause of blindness and occurs as a result of long-term accumulated damage to the small blood vessels in the retina. Diabetes is among the leading causes of kidney failure (WHO& IDF, 2012). With such complications, a number of the diabetic patients are hospitalized reducing on their productivity and at worst leading to death.

Decades of research have shown that the burden of type 2 diabetes mellitus is attributed to multiple lifestyle factors (Booth, et al., 2013). Proximate risk factors for type 2 diabetes mellitus are obesity, family history, frequent use of alcohol and tobacco and unhealthy dietary patterns (Malik, et al., 2010).

The aim of this study is to assess the dietary patterns of type 2 diabetic patterns in Jinja regional referral hospital as risk factors for their weight status (obesity). Ignorance about the risk factors, prevention and management of type 2 diabetes is a problem amongst most communities in Uganda (Mayega, 2014).

1.2 PROBLEM STATEMENT

There is a close association between weight status (obesity) and type 2 diabetes. The likelihood and severity of type 2 diabetes are closely linked with body mass index (BMI). There is a seven times greater risk of diabetes in obese people compared to those of healthy weight, with a threefold increase in risk for overweight people.

Being overweight or obese increases a person's risk for developing type 2 diabetes. Also, weight gain in people with type 2 diabetes makes blood sugar levels even harder to control. Weight gain (obesity) among these patients may be due to their dietary patterns that is to say their food intake among many other factors.

Dietary patterns of an individual play a very big role in their body mass index (BMI) which predisposes them to type 2 diabetes. Though dietary management is a key component of type 2 diabetes management, limited research has been done to find out the dietary patterns of these patients in Jinja District.

1.3 OBJECTIVES

The general objective of this study is to assess the dietary patterns of type 2 Diabetic patients in Jinja Regional Referral Hospital aged 20-65 years.

Specific objectives of the study:

- To determine the weight status of patients with Type 2 Diabetes aged 20-65 years.
- To determine which food group is most consumed by type 2 diabetic patients.
- To determine the relationship between type 2 diabetes and weight status (obesity) of the patient.

1.4 RESEARCH QUESTIONS

- Are all type 2 diabetic patients overweight or obese?
- What food group is most consumed by type 2 diabetic patients?

1.5 SCOPE OF THE STUDY

1.5.1 Study area

The study was conducted in Jinja Regional Referral Hospital located in Jinja district in Eastern Uganda. The target population was to include type 2 diabetic patients who had come to the diabetic clinic aged 20-65 years.

1.5.2 Time of the study

Data collection was done in July 2019 and the data collected was analyzed and the dissertation written and handed in at the University for evaluation in late August 2019.

1.6 OUTCOME OF THE STUDY

This study will help in understanding the factors affecting the dietary patterns of these patients. The dietary practices and life style factors responsible for obesity and overweight among type 2 diabetic patients will also be identified.

The findings will help to provide a better dietary plan and life style modification advice to the patient.

CHAPTER TWO: LITERATURE REVIEW

2.1 Trends of type 2 diabetes mellitus

2.1.1 Global trends

According to (Whiting, 2011) a total of 565 data sources were reviewed, of which 170 sources from 110 countries were selected. In 2011 there are 366 million people with diabetes, and this is expected to rise to 552 million by 2030. The top ten countries with the highest number of people with type two diabetes mellitus include, china with 90 million, India with 60.1 million, USA with 23.7 million, Russia with 12.6 million, Brazil with 12.4 million, Japan with 10.7 million, Mexico with 10.3 million, Bangladesh with 8.4 million, Egypt with 7.3 million and lastly Indonesia with 7.3 million people.

The largest increases are expected in the older age groups in low and lower-middle income countries, with numbers more than doubling for the over 60-year age-group. The overall total predicted increase in numbers with diabetes from 2011 to 2030 is 50.7%, at an average annual growth of 2.7%, which is 1.7 times the annual growth of the total world adult population (Rowley, et al., 2017).

2.12 Trends in Africa.

Sub-Saharan Africa, like the rest of the world, is experiencing an increasing prevalence of diabetes alongside other non-communicable diseases. In 2010, 12.1 million people were estimated to be living with diabetes in Africa, and this is projected to increase to 23.9 million by 2030. Prevalence in the general population of T2DM recorded in these studies ranged from 0.6% in rural Uganda to 12% in urban Kenya. A low to medium prevalence (0-7%) was recorded in Cameroon, Ghana, Guinea, Kenya, Nigeria, South Africa and Uganda and a very high prevalence (> 10%) was recorded in Zimbabwe. Variation in prevalence recorded within countries was common (Hendrickson, 2011).

Prevalence estimates varied considerably between different studies for some countries, with estimates for rural South Africa ranging from 3.9% to 8.8%. Variation between urban and rural

populations was frequently observed, with a higher prevalence recorded in urban populations. . Prevalence recorded in Christensen's Kenyan survey ranged from 2% in rural areas to 12% in urban areas. The prevalence also ranged from 18% in urban Libya to 13% in 13.1% in rural Egypt (Maliik & Wegner, 2012)

2.1.3 Trends in Uganda

A cross-sectional study in Kampala and Mukono districts in 2012 estimated the prevalence of type 2 diabetes mellitus to be 7.4 % amongst adults. A recent study has shown that the prevalence in the very area has increased to 8% (Loggins, 2012). Prevalence estimates for diabetes have varied from 0.4% in cross-sectional surveys around the shores of Lake Victoria to 8.1% in towns close to the city of Kampala and 9.0% in foothills of Rwenzori Mountains in Western Uganda. (Bahendeka&Wesonga, 2016).

2.2. Pathophysiology of type 2 diabetes mellitus.

Type 2 diabetes is due to insufficient insulin production from beta cells in the setting of insulin resistance. Insulin resistance, which is the inability of cells to respond adequately to normal levels of insulin, occurs primarily within the muscles, liver, and fat tissue. In the liver, insulin normally suppresses glucose release. (Kaku, et al., 2010). This leads to an overall rise in the level of glucose in the blood. Glycogen stores become markedly reduced and there is less glucose available for release when it may be needed. Obesity and lack of physical activity are thought to be major causes of insulin resistance. (Booth, et al., 2013).

2.3. Association between different risk factors and type 2 diabetes mellitus

2.3.1 BMI and type 2 diabetes mellitus

There is a close association between BMI and risk of developing T2D, the relative risk of T2D increasing with BMI. For each kilogram of weight gained annually over a period of 10 years, there is an associated 49% increase in the risk of developing T2DM in the subsequent 10 years. Conversely, for each kilogram of weight lost annually over 10 years, there is an (Daousi, et al., 2010) associated 33% reduction in the risk of developing T2DM in the subsequent 10 years

Increased fat accumulation results into elevated nonesterified fatty acid (NEFA) levels in the plasma that in turn results into insulin resistance hence increasing risks for type 2 diabetes

mellitus (Karpe, Dickmann, & KN, 2011). An increase in body fat is generally associated with an increase in risk of metabolic diseases such as type 2 diabetes mellitus, hypertension and dyslipidemia (WHO, 2003) Body mass index (BMI) criteria are currently the primary focus in obesity treatment recommendations, with different treatment cutoff points based upon the presence or absence of obesity-related co-morbid disease. In addition, many patients with these metabolic diseases are either over-weight or obese. While these simple clinical concepts may be well-accepted among many clinicians and researchers, and assumed to be readily accessible in the medical literature, the authors are unaware of any previous reports in which data regarding the important relationship between BMI and T2DM (Enolgear., et al, 2001)

2.3.2 Diet and type 2 diabetes mellitus

Evidence from the Nurses' Health Study (NHS) revealed that diet quality plays an important role in the development of diabetes, independent of body mass index (BMI) and a series of other risk factors. Especially, higher dietary glycemic load and trans-fat intake are associated with increased diabetes risk, whereas higher consumption of cereal fiber and polyunsaturated fat are associated with decreased risk (Hu, Manson, & Stampfer, 2007).

In a number of studies, the results from the NHS indicated that the higher nut and peanut butter consumption will lower the risk of type 2 diabetes (Dietz, 2009), and the higher consumption of sugar-sweetened beverages is associated with a greater magnitude of weight gain and an increased risk for development of type 2 diabetes (ADA, 2008), yet higher potato and French fry consumption are both positively associated with the incident type 2 diabetes and this association is more pronounced in those with obesity (Malik, et al., 2010)

A large number of prevention studies concerning dietary factors have been conducted in many countries during the past several years. Studies from China, Japan and India aimed at examining the effects of reducing fat, refined carbohydrates and alcohol and increasing fiber intake on the development of T2DM (XR, Li, Hu, et al., 2007) The Finnish Diabetes Prevention Study (DPS) advocated decreasing total and saturated fat intake and increasing fiber density in the diet. In the Diabetes Prevention Program (DPP), dietary goals were to reduce total fat and energy intake (Lindström, Eriksson, Valle, et al., 2003). A Mediterranean diet characterized by a high intake of vegetables, fruit, legumes, extra virgin olive oil, nuts, fish, whole grains and red wine also

showed a remarkable decrease in the incidence of diabetes in a Spanish study (Salas-Salvadó, et al., 2011).

2.3.3 Smoking and type 2 diabetes mellitus

With rapid globalization and socioeconomic development, smoking and alcohol consumption are becoming more and more common and arouse increasing public concern. Meta-analysis found that active smoking is positively associated with an increased risk of type 2 diabetes (Wili, Bodonmann, Ghali, Farah, & Cornuz, 2013).

Compared with nonsmokers, current smokers had a 45% increased risk of developing diabetes. The association between the number of cigarettes smoked and diabetes risk was consistent with a dose-response phenomenon. There are several mechanisms that contribute to the association between smoking and type 2 diabetes. Smokers tend to be thinner than nonsmokers or former smokers, but smokers tend to gain weight when they quit smoking, and heavier smokers tend to gain more weight than light smokers (Shimokata, Muller, & Andres, 2010).

Even with a normal BMI, smokers tend to have a greater risk of having abdominal obesity than nonsmokers, because smoking has an anti-estrogenic effect and can disorder the hormonal balance and then lead to abdominal obesity. General obesity and abdominal obesity are both strongly associated with the development of type 2 diabetes (Jin, Huang, & Bi, 2011).

Smoking cessation is important in decreasing the risks of diabetes-related macro-vascular and micro-vascular complications (Salmeron, Ascherio, 2012). There is increasing evidence that cigarette consumption has a synergetic effect with diabetes and increases the morbidity and mortality of type 1 and 2 diabetic patients. Smoking has been reported to be associated with hypoglycemia in previous clinical studies (Hirshman, et al., 2003) The most common causes of mortality among individuals with diabetes are cardiovascular and renal complications both of which have been related to cigarette smoking. Moreover, smokers experience four times the risk of death from all cardiovascular disease and three times the risk of death from coronary artery disease (WHO, 2008).

2.3.4 Alcohol intake and type 2 diabetes mellitus

Several biological mechanisms have been proposed to explain the apparent reduction in risk of type 2 diabetes amongst moderate drinkers. These include the anti-inflammatory hypothesis, which poses that alcohol may beneficially alter the expression of inflammatory proteins implicated in metabolic processes (Akash, Rehman, Chen, 2013) including adiponectin (Brien, et al, 2011) and interleukin- 1 β , and a possible stimulatory effect of alcohol upon the synthesis of high-density lipoprotein(Akash, Rehman, Chen, 2013). However, studies investigating such mechanisms are subject to notable limitations, including short follow-up periods and small sample sizes, limiting the generalizability of findings both at the population level and over the long term.

It is possible that reductions in risk identified between moderate alcohol exposure and incident type 2 diabetes may occur partly as an artifact of referent group selection, particularly where confounder adjustment is weak (Shaper, 2000). To date, observational studies have commonly adopted pooled non-drinkers as the unexposed referent category. However, non-drinkers are far from homogeneous, comprising both never and former drinkers. Former drinkers are particularly notable, displaying poorer health and higher levels of mortality than moderate and never drinkers (Nishino, et al., 2005). Many existing alcohol-diabetes studies may have therefore overestimated the degree of risk reduction among moderate consumers of alcohol by comparing drinkers to a less healthy non-drinking referent category. Indeed, in a meta-analysis exploring the relationship between alcohol consumption and all-cause mortality, reductions in risk were attenuated when data were restricted to studies that excluded former drinkers from the referent category ((Daousi, et al., 2010).

3.3.5 Physical activity

Physical inactivity has been sighted out to the one of the risk factors for type 2 diabetes mellitus. A sedentary lifestyle is directly linked to the risk of type 2 diabetes mellitus. A survey carried out by the NHS showed that individuals who watched TV for 4hours per day increased their risks of getting type 2 diabetes mellitus by 14%. The adoption and maintenance of physical activity are critical foci for blood glucose management and overall health in individuals with diabetes and pre-diabetes (Avery, et al., 2015).

Recommendations and precautions vary depending on individual characteristics and health status. Physical activity includes all movement that increases energy use, whereas exercise is planned, structured physical activity (Chen, Pei, & Kuang, 2015).

Exercise improves blood glucose control in type 2 diabetes, reduces cardiovascular risk factors, contributes to weight loss, and improves well-being. Regular exercise may prevent or delay type 2 diabetes development. Regular exercise also has considerable health benefits for people with type 2 diabetes (e.g., improved cardiovascular fitness, muscle strength, insulin sensitivity, etc. (Booth, et al., 2013).

In a South African study, the prevalence of a sedentary lifestyle in Cape Town in subjects age 30 years and over was 39 percent for men and 44 percent for women (Omar et al., 1993). Low physical activity was normal for 22 percent of men and 52 percent of women in urban Tanzania, whereas it was usual for only 10 percent of men and 15 percent of women living in rural areas (Edwards et al., 2000). Cross-sectional data from 1,417 women age 15 to 83 years in a rural community and an urban community in Cameroon showed that in all age groups, fasting blood glucose levels were inversely associated with energy expenditure from walking (Sobngwi, et al. 2003). Rural dwellers' higher level of physical activity and related energy expenditure compared with urban subjects goes far to explain why obesity was found to be at least four times higher in urban areas than rural (Aspraly et al., 2000). Thus, lack of physical activity appears to be a significant risk factor for diabetes in Sub-Saharan Africa.

CHAPTER THREE: METHODOLOGY

This chapter contains the various tools that will be used in the course of data collection.

3.1 Location of study

The study is to be conducted in Jinja district in Eastern Uganda, specifically Jinja Regional Referral hospital (JRRH) diabetic clinic.

3.2 Study design

This study was a cross sectional study that included random sampling of respondents who were to participate in the study. It utilized structured interviews using a well designed questionnaire to assess the dietary patterns of type II Diabetic patients.

3.3 Study population

The study included patients from 20 years of age to 65 years who came to the diabetic clinic at the hospital.

3.4 Selective criteria of participants

3.4.1 Inclusive criteria

Only patients who came to the diabetic clinic and were between the age of 20 and 65 and had given their consent to participate in the study.

3.4.2 Exclusion criteria

Individuals at the diabetic clinic who were below the age of 20 years and those above 65 years, and also those who did not want to participate in the study and refused to give consent were to be excluded.

3.5 Sample size

The sample population was obtained using the Fisher et al., 1998 formula as indicated below;

$$N = Z^2 P / d^2$$

Where; N is the sample size

$$Z = 1.96$$

P is the prevalence estimator²

$$q = 1 - p$$

d = the confidence interval which will be 0.05

A prevalence estimator of 7.4% indicating prevalence of Type 2 diabetes mellitus amongst adults in Eastern Uganda was used (Bahendeka & Wesonga, 2016).

3.6 DATA COLLECTION TOOL

A well designed questionnaire comprising of closed ended and open ended questionnaires were prepared to assess the dietary patterns of the patients.

3.7 RESULTS

The results from the study were analyzed using the statistical package for social scientists (SPSS).

3.8 ETHICAL CONSIDERATION

Respondents were requested to participate in the study after I had explained to them the possible benefits of the study. The information that was presented at the hospital where I was going to carry out the study.

CHAPTER FOUR:RESULTS

4.1 Descriptive statistics (Frequencies and percentages)

4.1.1 Social demographic characteristics

Table 1 shows that over a half (58.1%) of the participants were female whereas 41.9% were male. The age group with the highest percentage of participants which was 40% was the group 41-50 years followed by that of 51-65 years with a percentage of 39. And that of 21-30 years had the least percentage of participants which was 8.6%.

The percentage of participants who were not educated/stopped at primary level was 39%, 46.7% had studied up to Secondary level and, 7.6% had attained diplomas and 4.8 % had a studied up to bachelors degree level. The percentage for others was 1.9% and this included certificate holders. There were no masters and PHD holders registered. For the marital status, majority of the participants were married contributing to a percentage of 69.5%. 16.2% of the participants were single, 11.4% were widows, and only 2.9 % were widowers.

Majority of the participants were Moslems with a percentage of 29.5 followed by Catholics with 26.7%, thenAnglicans with 25.7%, Pentecostals with 11.4%, SDAs with 5.7 % and other denimonations contributing 1%.

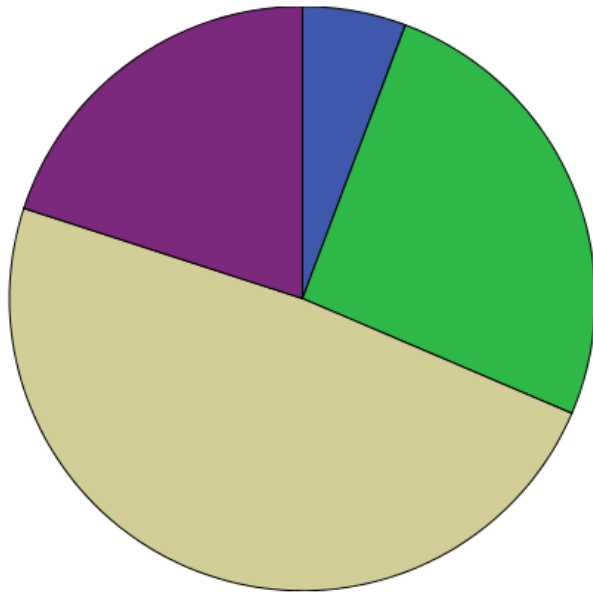
Majority of the participants were manual workers with these making up to 78.3% and the percentage for sedentary l workers was 25.7%.

Table 1: Social demographic characteristics of the participants:

Characteristic	Frequency	Percentage
Sex		
Male	44	41.9
Female	61	58.1
Age		
21 - 30 years	9	8.6
31-40 years	13	12.4
41-50 years	42	40
51-65	41	39.0
Level of education		
Primary	41	39
Secondary	49	46.7
Diploma	8	7.6
Bachelors	5	4.8
Others(certIFICATE)	2	1.9
Marital status		
Married	73	69.5
Single	17	16.2
Widow	12	11.4
Widower	3	2.9
Religion		
Moslem	31	29.5
Catholic	28	26.7
Anglican	27	25.7
Pentecostal	12	11.4
SDA	6	5.7
African traditionalists	1	1.0
Nature of Work		
Manual	74.3	74.3
Sedentary	27	25.7

4.1.2 BMI of the participants

Majority of the participants were overweight with a percentage of 48.6%. 20% of the participants were obese, 25.7% of the participants were of normal weight and only 5.7 were underweight.



- underweight (less than 18.5)
- normal (18.5-24.9)
- Over weight (25-29.9)
- obesse (30 and above)

Figure 1Body Mass Index (BMI) for participants

1.3 Lifestyle of the participants

The percentage of participants who were taking alcohol was 10% whereas those who didn't take alcohol were 90%. Most of these people took alcohol 1 to 2 days a week.

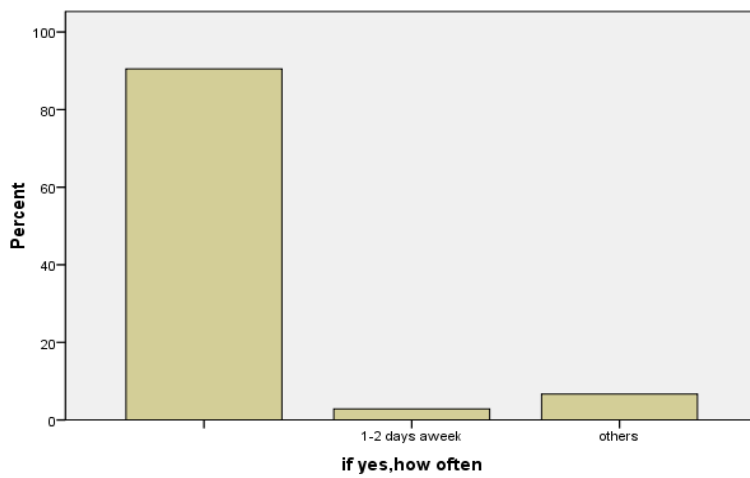
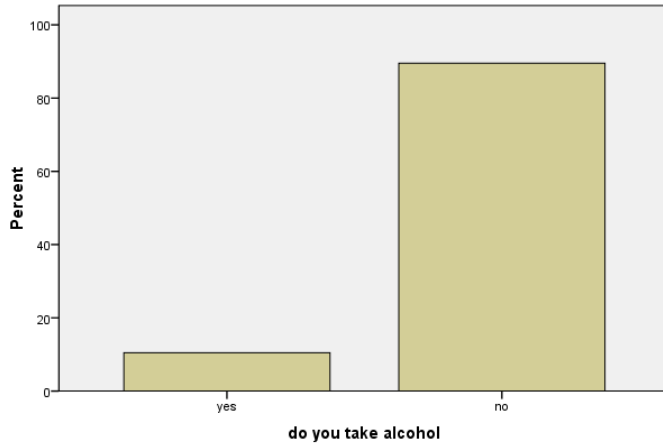


Figure 2Frequency of alcohol intake of participants

Of all the participants only 1.9 % smoked tobacco whereas 98.1% of the participants did not smoke tobacco. Of the people who were engaged in smoking, most of them smoked 1 to 2 days a week and others.

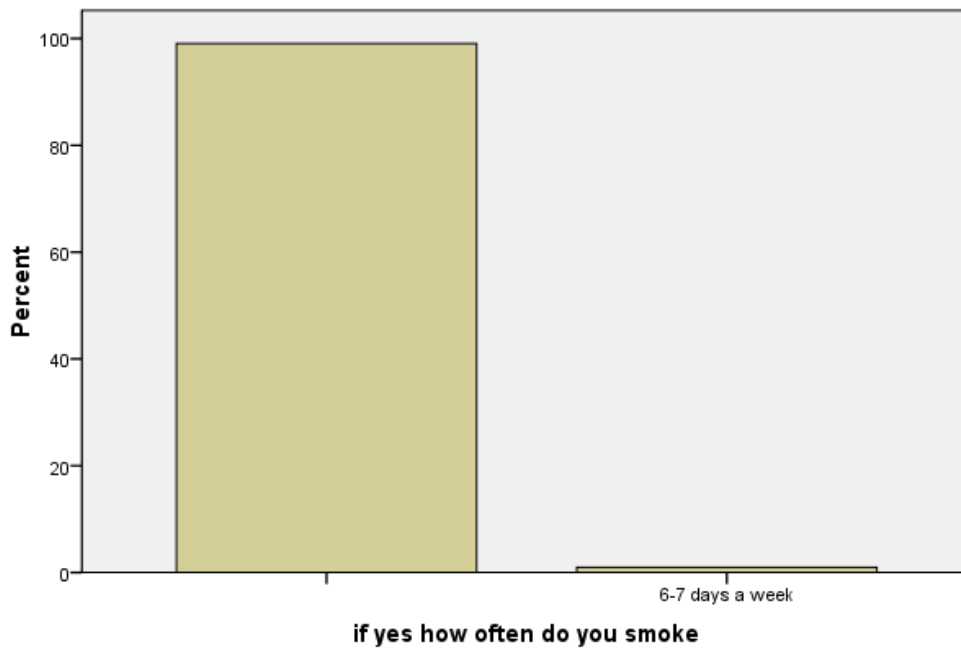


Figure 3 Frequency of tobacco smoking of the participants.

The largest proportion of the participants reported to have engaged in physical exercise and their percentage was 75.2% and that of those that were not engaged in physical exercise was 23.8%. The majority of the people that were engaged in physical activity were people that exercised 1 to 2 days a week. Most of them reported to have been engaged in jogging and manual work like walking, digging lifting as their form of exercise.

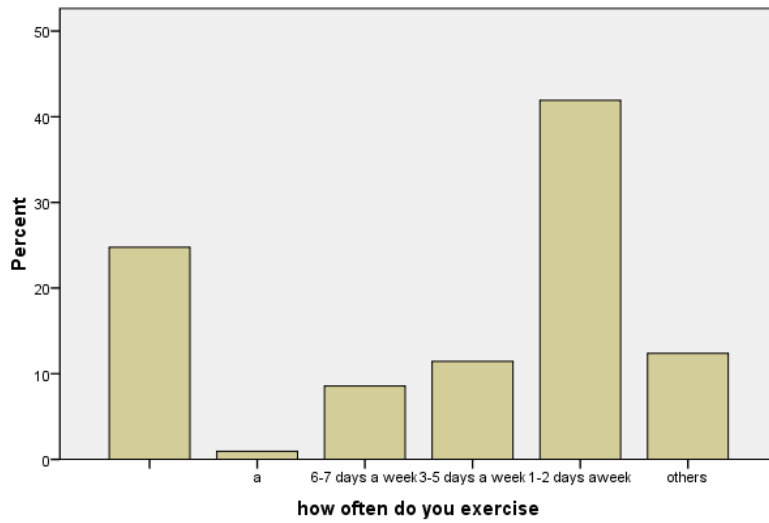


Figure 4 Frequency of exercise of the participants

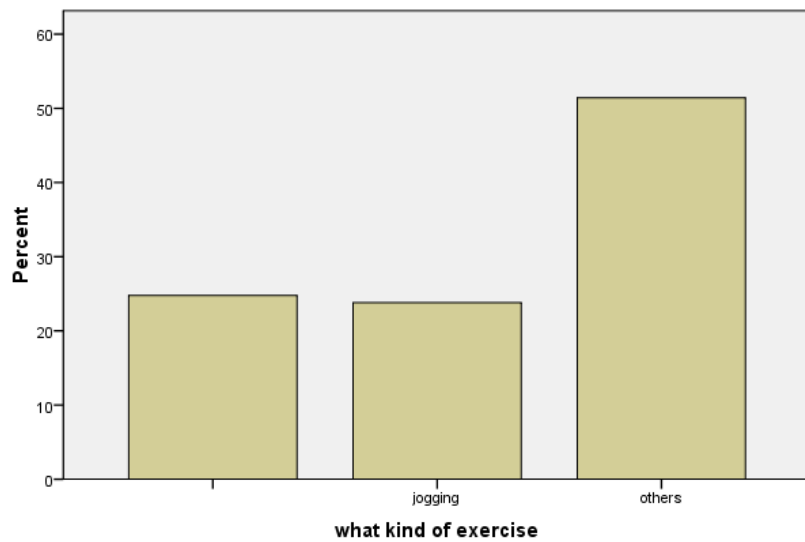


Figure 5 Type of exercise participants involve in.

4.1.4 Knowledge of type 2 diabetes

All the participants who participated in the study had been tested for type 2 diabetes and just returned to the health facility for routine checkup and to receive medication.

Of all the participants, 63.8% had last tested that month, 25.7% the previous month, 8.6% had last tested 3 month ago and only 1% listed others.

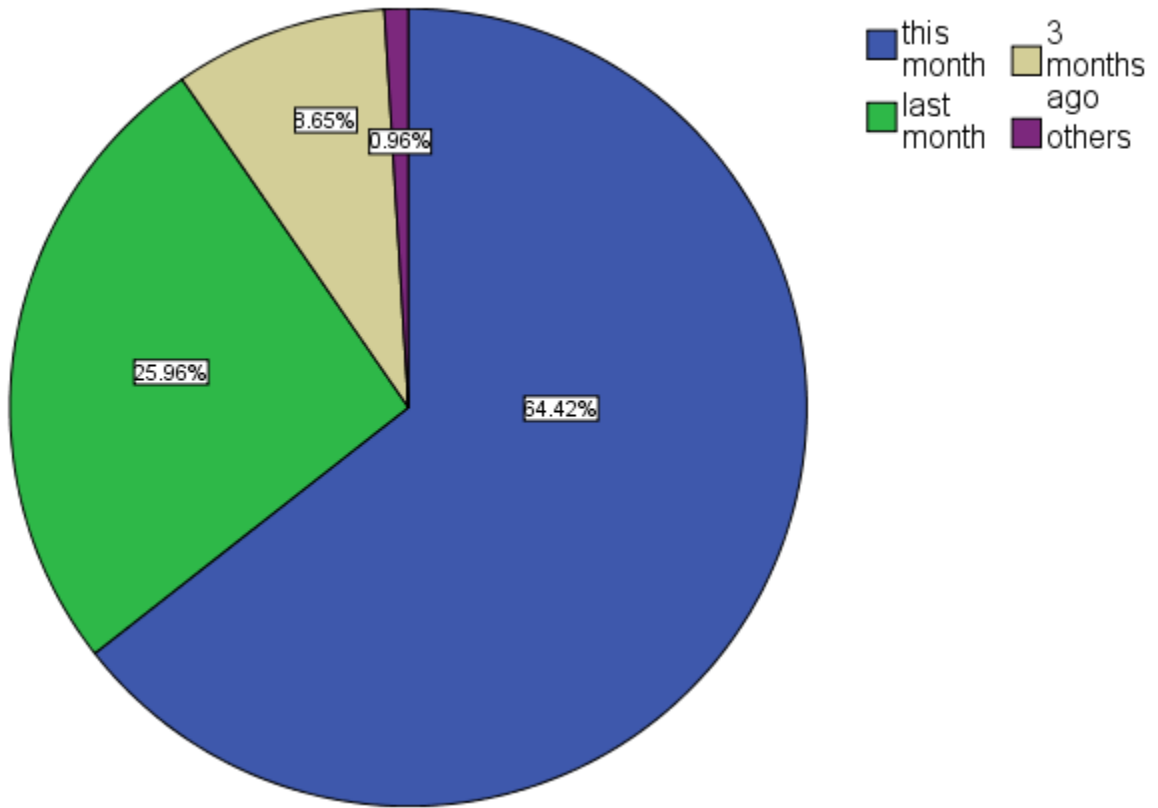


Figure 6 Time when participants last tested for T2DM

Of all these, 87.6 % had their blood glucose levels above normal when they tested leaving only 2.6% with blood glucose levels below normal or normal.

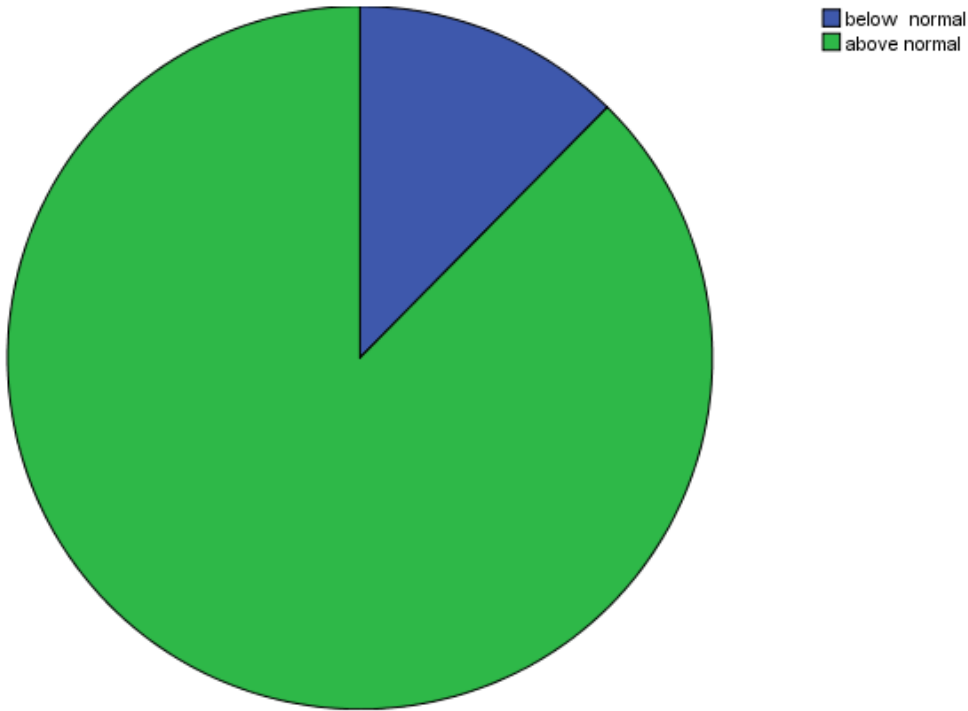


Figure 7 Blood glucose levels of the participants

4.1.5 Information on Type 2 Diabetes mellitus

Figure 7 shows that the percentage of the participants had who received information about type 2 diabetes mellitus management was 88.57% whereas 11.43% had not received any information about type 2 diabetes mellitus management. The majority of the people who received information about type 2 diabetes mellitus had received it on monthly basis at the hospital and from a health worker.

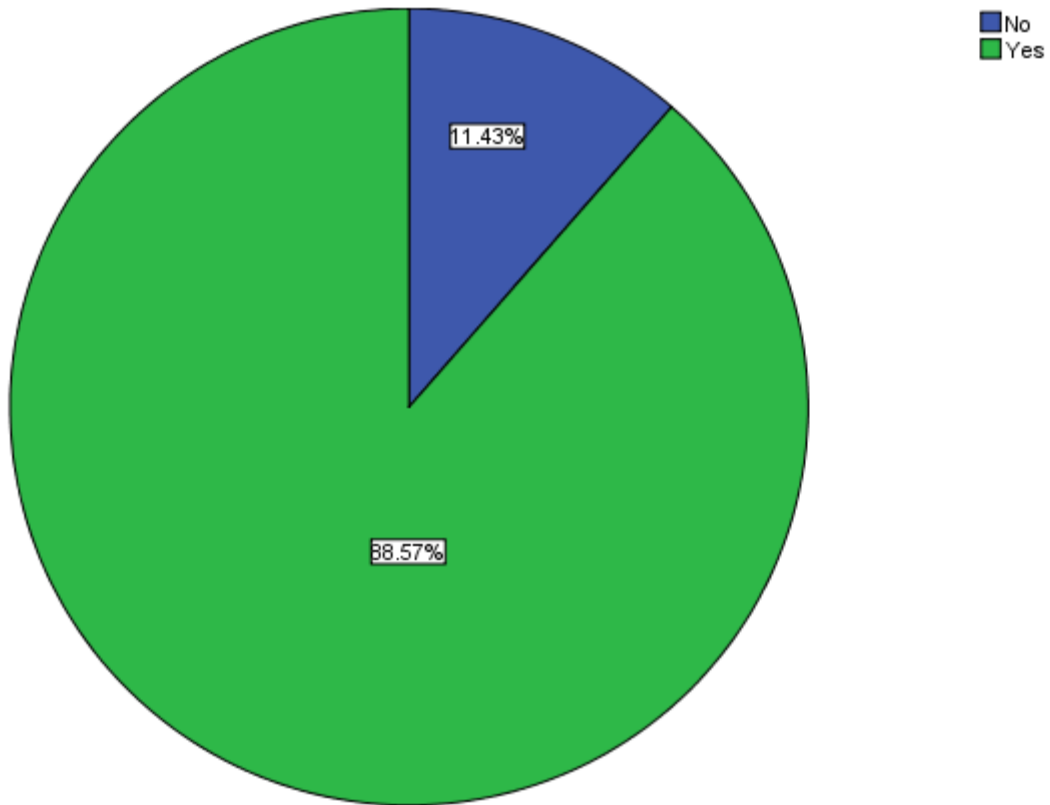


Figure 8 Participants who received information on T2DM management

4.1.6 Dietary intake of the participants

Data analysis from the 24 hour recall showed that majority (52.8%) of the participant's daily energy intake was more than 1800Kcal which is the RDA for energy according to Reyten, etal. The percentage of individuals whose daily energy intake was less than the normal was 47.2%. Some of the major sources of calories were cereals, tubers and plantain, oil.

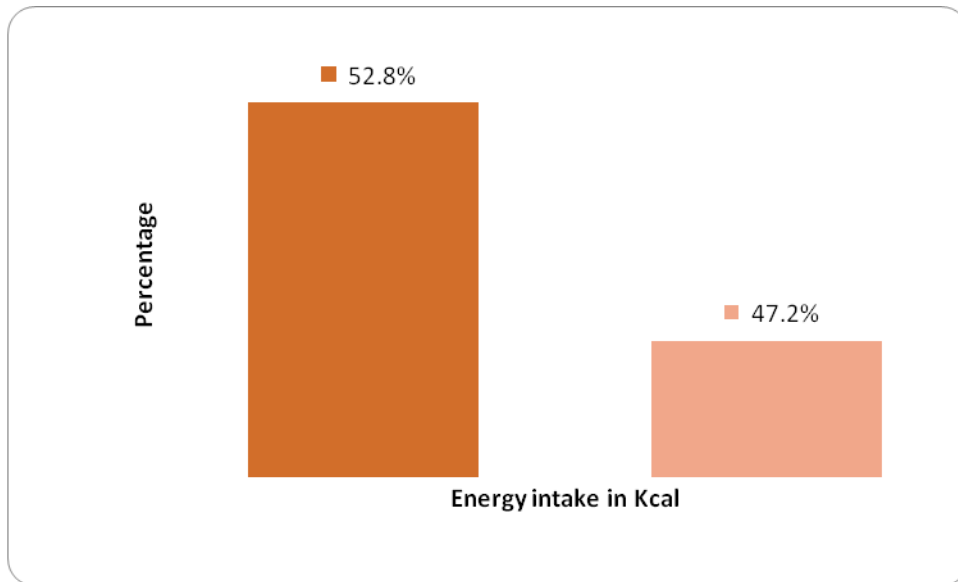


Figure 9 daily energy intake of participants

Cereals were the most consumed food in a day with a percentage of 71.4%, followed by legumes with 55.5 %, tubers and plantain with 37.1%, then vegetables with 21.9%, and dairy, fats and oils with 19.0%. The percentage for fruits was 11.4% and animal products had the least percentage of only 3.8 %. Therefore cereals were the most consumed foods in a day whereas animal products were consumed the least.

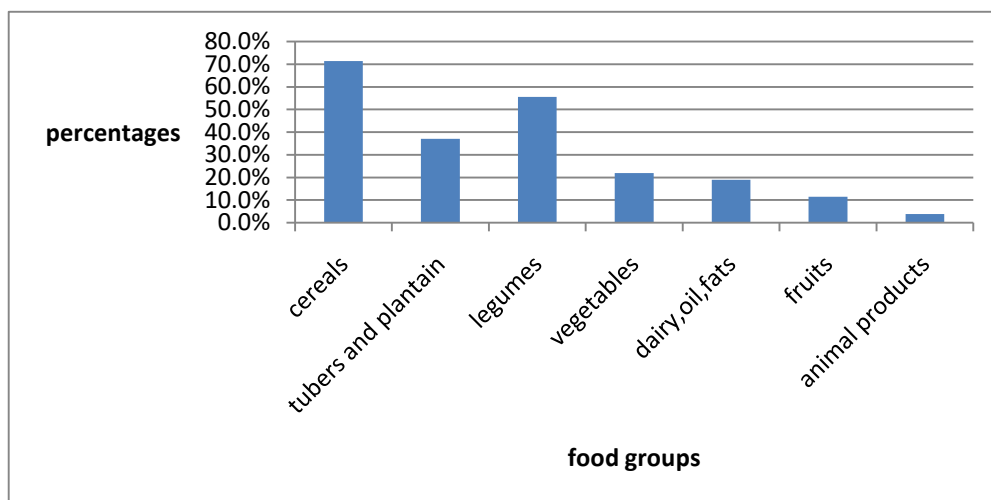


Figure 10 Daily consumption of different food groups

4.1.6 Food frequency of the participants.

This was to determine how often the different food groups were eaten by the participants. There was five food groups described to the participants. Cereals, tubers and plantain, legumes, dairy, oil and fat, animal products, vegetables and fruits.

Cereals

Over 87.62 percent of the participant's consumed cereals on a daily. And only 11.4% reported to eat cereals on weekly basis but not every day of the week.

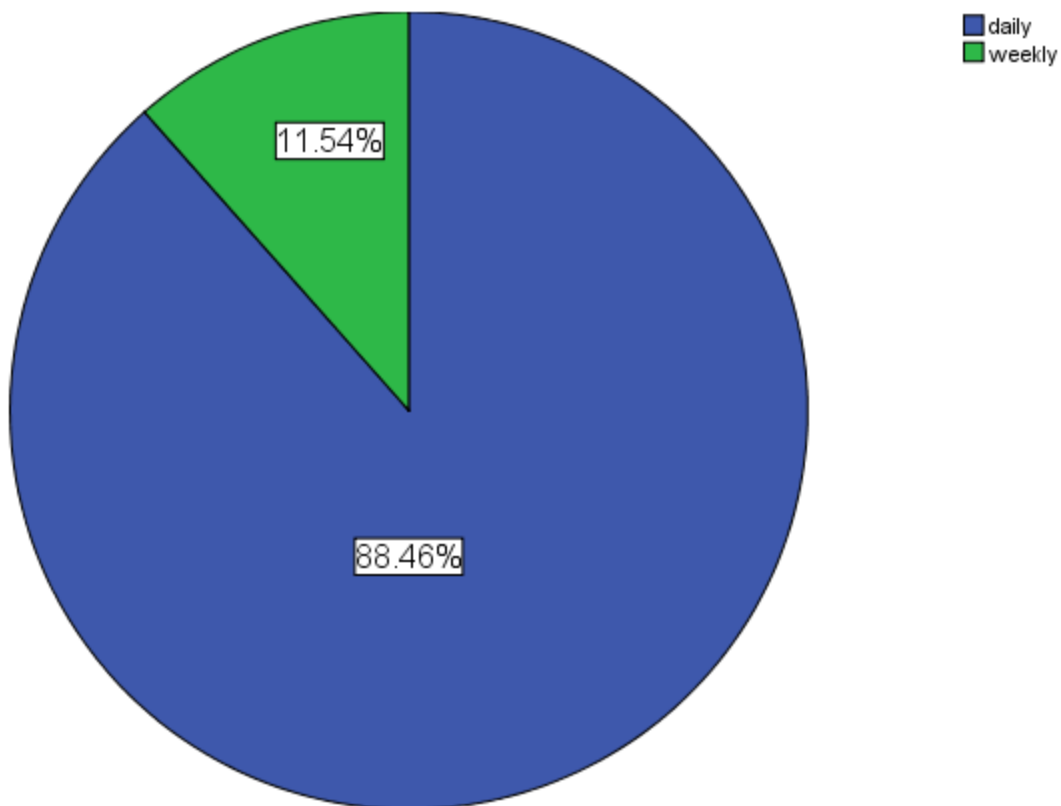


Figure 11 Frequency of cereal consumption of participants

Tubers and plantain.

70.5% of the participants consumed tubers and plantain on a daily basis. 26.7% consumed weekly, and only 1% consumed tubers and plantain rarely.

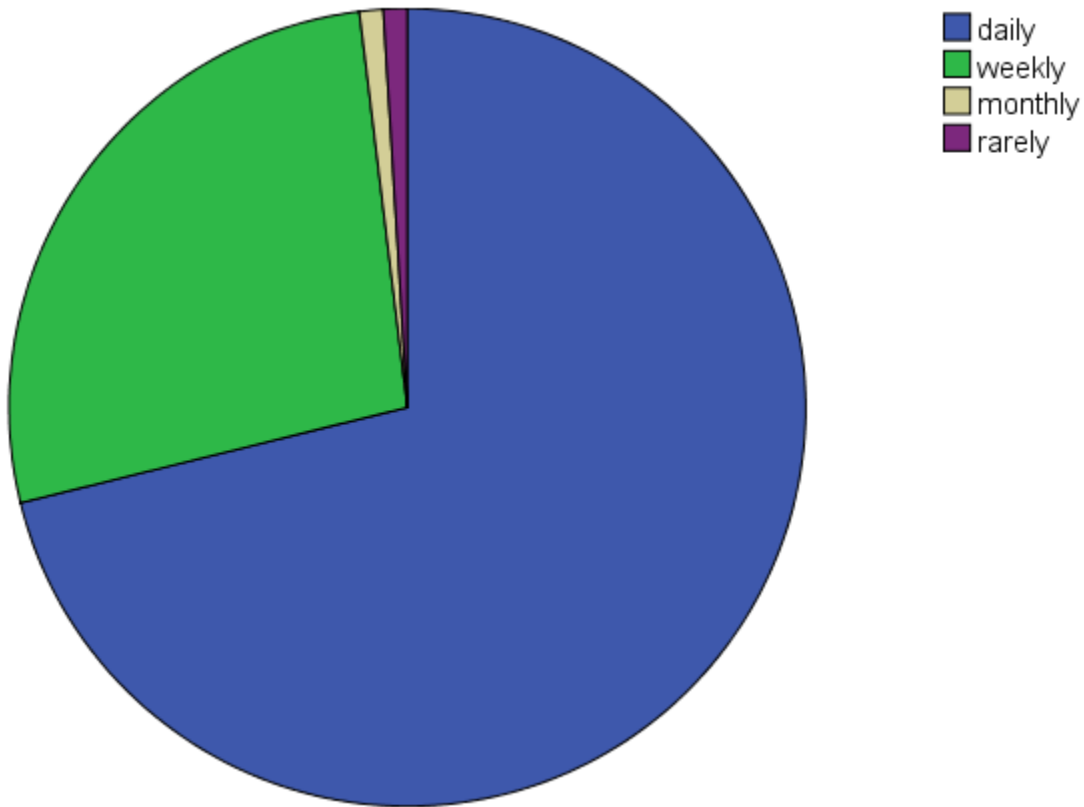


Figure 12 Frequency of consumption of plantain and tubers

Legumes

76.2% of the participants consumed legumes daily, 21.0% weekly and only 1.9% reported to have consumed legumes rarely.

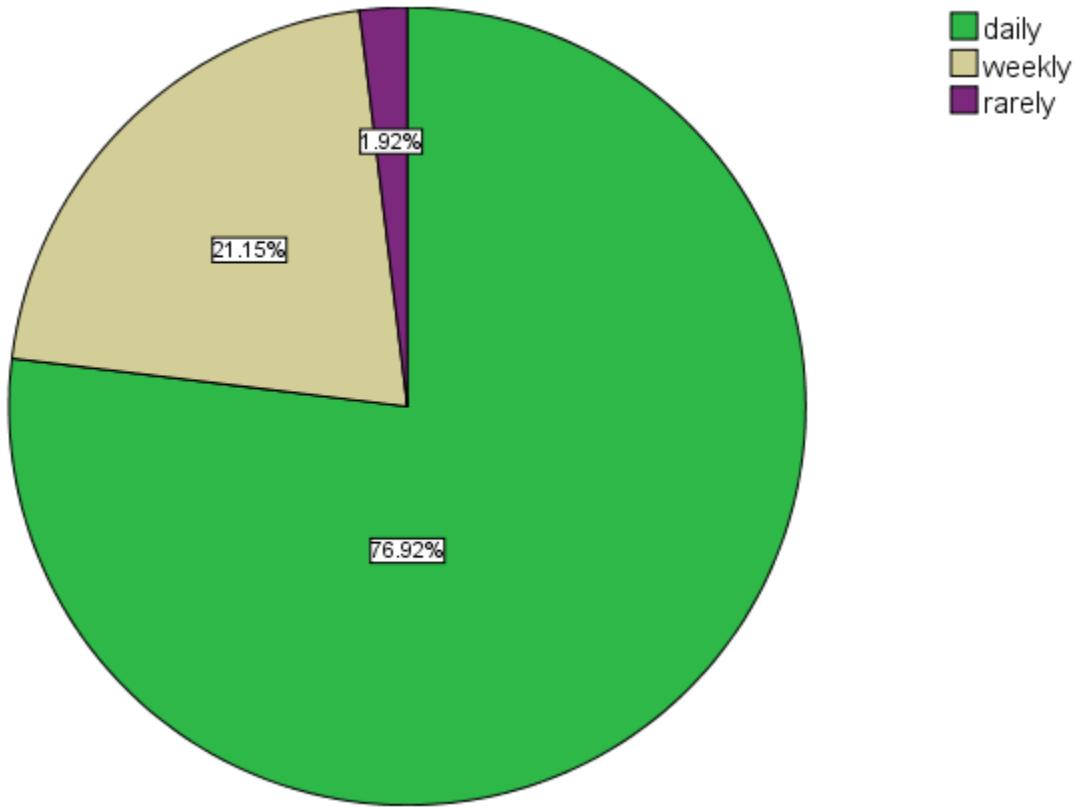


Figure 13 Frequency of consumption of legumes by participants.

Diary, oil and fat.

Only 7.62% of the participants consumed milk on a daily basis , 19.05% weekly , 17.19% on w monthly basis , 35.24% rarely consumed dairy products, and 20% of the participants did not consume dairy products.

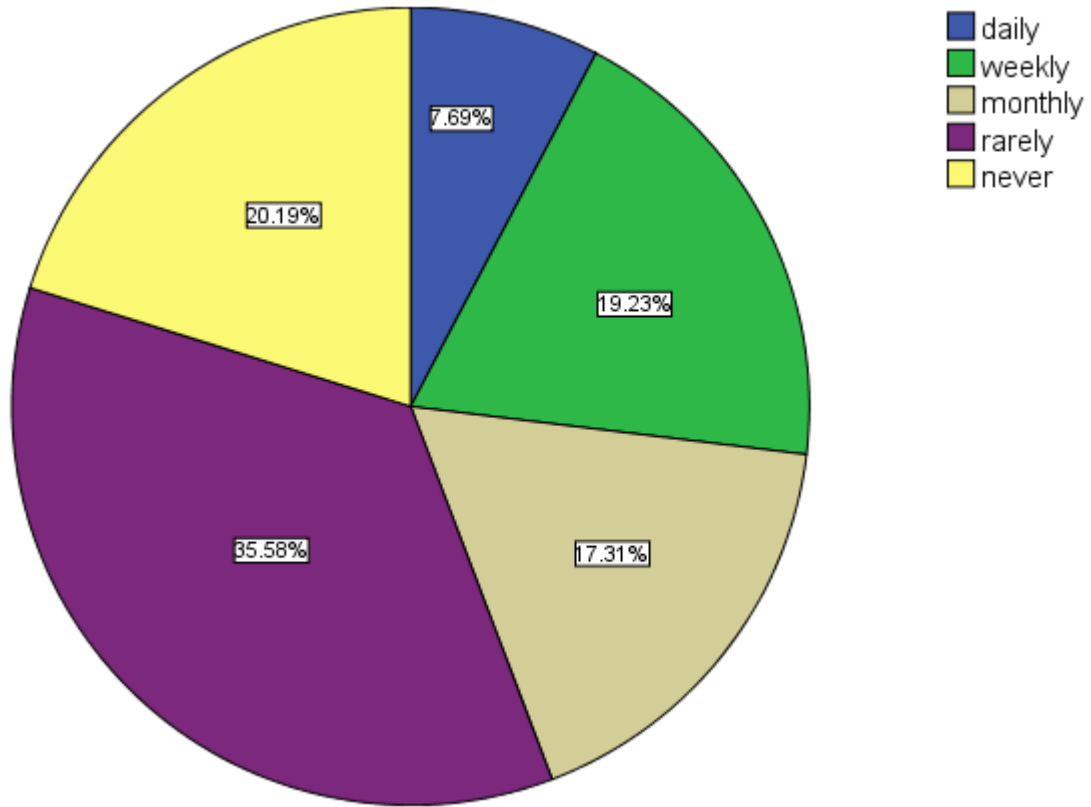


Figure 14 frequency of consumption of dairy, fat and oils by the participants

Animal products

Only 4.8% of the participants consumed animal products daily, 17.1% consumed meat products weekly, 18.1% monthly, 47.6% rarely and 11.4% didn't consume meat products at all.

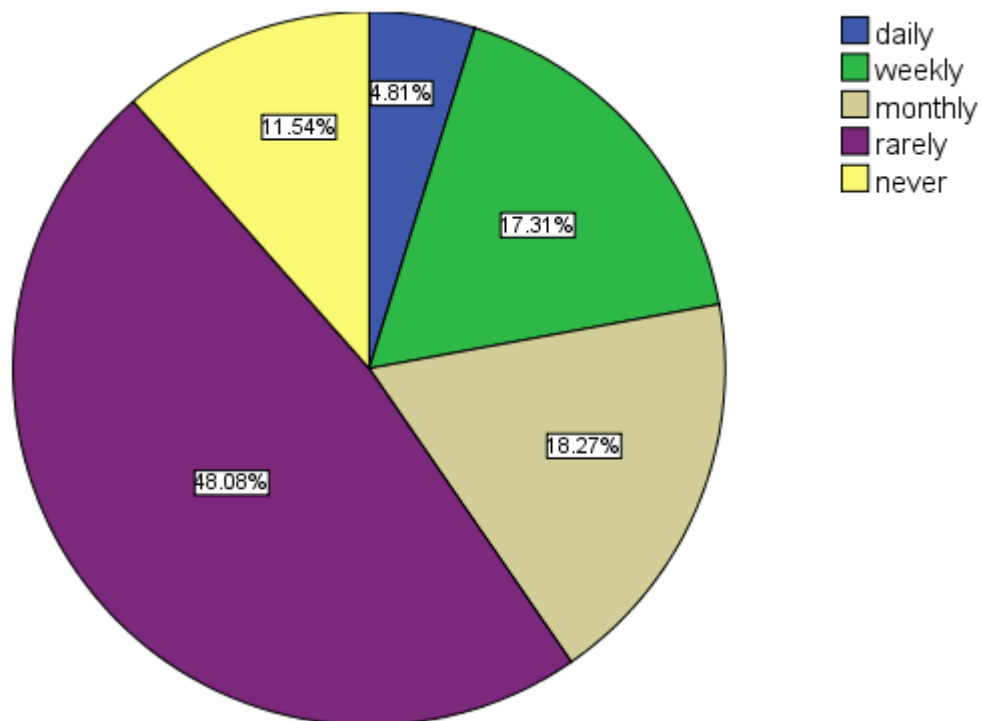


Figure 15 frequency of consumption of animal products by participants

Vegetables

Over 66.7% consumed vegetables on a daily basis, 22.9% weekly, 2.9% monthly and only 6.7% reported to rarely consume vegetables.

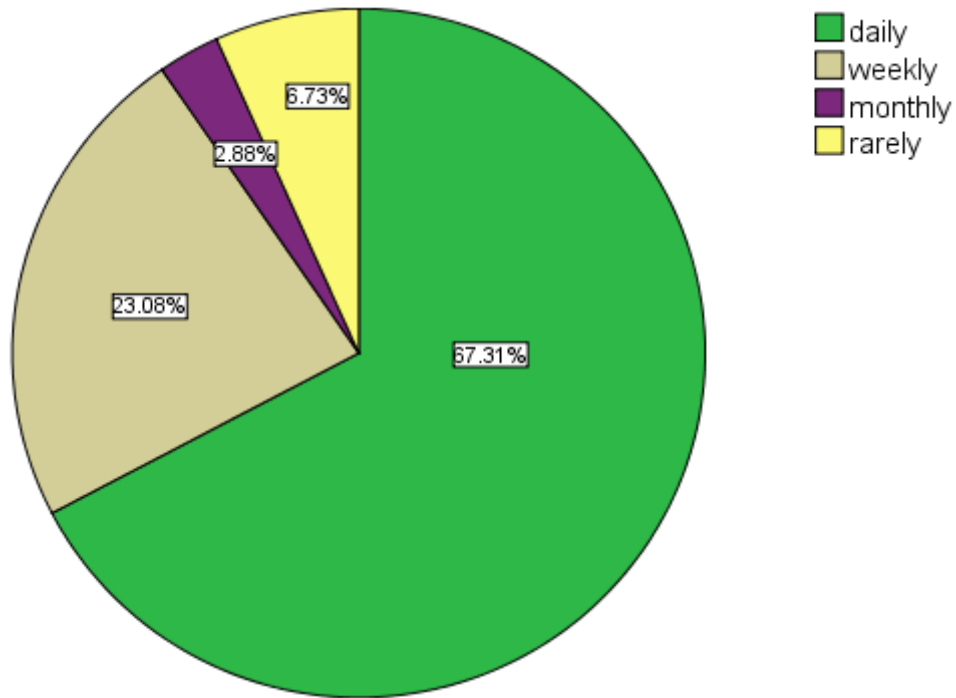


Figure 16 frequency of consumption of vegetables among participants

Fruits

Only 12.4% of the participants ate fruits daily, 39.0% weekly, 9.5% monthly, 29.5% rarely and 8.6% didn't eat fruits at all.

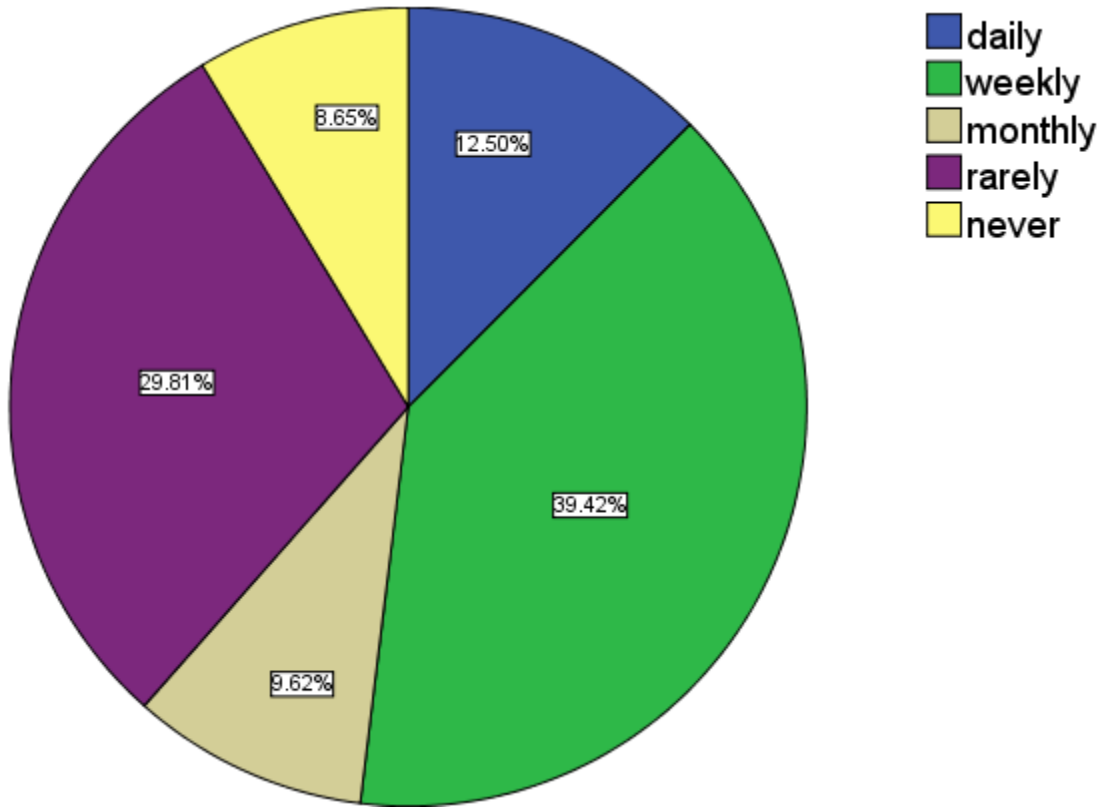


Figure 17 frequency of consumption of fruits among participants

CHAPTER FIVE: DISSCUSSION OF THE RESULTS.

5.1 Social demographic characteristics and type 2 diabetes mellitus

Married people were the majority according to my results. Ginerize & Frezle, 2003 explains the relationship between age and marital status. Since my study was carried out amongst the adults, this could have been a reason for the high percentage of married people. In general, Christians were more than the rest of the people belonging to other religious groups and this is in accordance with (Uganda Bureau of Statistics, 2016) where Christians were found out to make 85% of Ugandans population. A number of studies have proved the increasing change in the attribute to work preferences. It was noted that majority of the people mostly who have been to school preferred white collar jobs to blue collar jobs (Wellinuos, et al.,2012) which exposes them to a sedentary lifestyle (Chen, Pei, &Kuang, 2015). Since my study population reported few educated individuals, it explains why most of the participants were involved in manual work.

In a cross-sectional study carried in India it was noted that there was no significant relationship between the educational levels, age, and religion and type 2 diabetes mellitus (Ghamit, 2009). This was in accordance with the findings in my study. From the results of my study, there was no relationship between the sex of the participants and type 2 diabetes mellitus and this is contrary to results from a follow up study where it was noted that Type 2 diabetes mellitus was found to be more prevalent in women than in men (Fano, Pezzotti, Gnavi, 2005).

Results from a cross-sectional study in Ethiopia that the majority of the sedentary workers had higher blood glucose levels compared to the manual workers. This explains that a sedentary lifestyle can be a risk factor for type 2 diabetes mellitus (Malik, et al., 2010). Although Hu, Manson, &Stampfer, 2007 noted it that marital status plays an important role in the dietary intake of people, it was noted that there was no significant relationship between marital statuses and type 2 diabetes mellitus (Treacomm. et al, 2011).

5.2 BMI and type 2 diabetes mellitus

Body Mass Index (BMI) is one of the major risk factors for T2DM (Swinburn, 2002). For each kilogram of weight gained annually over a period of 10 years, there is an associated 49% increase in the risk of developing T2D in the subsequent 10 years. Conversely, for each kilogram

of weight lost annually over 10 years, there is an associated 33% reduction in the risk of developing T2D in the subsequent 10 years (Daousi, et al., 2010).

Contrary to my study, a study carried out in China amongst the middle- aged and the elderly people, it was found out that BMI as an anthropometric index was a risk factor for T2DM ($p=0.024$) at a significance level of 0.05. Higher BMI was associated with increased insulin resistance and decreased insulin sensitivity in elderly with recently diagnosed type 2 DM. This study shows that higher BMI may be the most important pathogenic factor and associated with type 2 DM in elderly Asian population. (Wang, et al., 2017). The differences in my study could have been attributed to a number of errors that could have been made during the process of taking weight and height as explained by (World Health Organization, 2005).

In another study carried out on the relationship between BMI and T2DM, it was noted that a higher BMI was a risk factor for T2DM. Respondents were followed up for a period of 3 years and results showed that there was a reduction in insulin sensitivity for the individuals who had gained over 15% body weight. For individuals who had less than 15% body weight gain, there insulin sensitivity didn't subsidize (Telford, 2007). Obesity due to genetic reasons has been a subject to discuss over the past decades. However it has to be noted that role of genetics in the onset of T2DM cannot be downplayed (Bullano, et al, 2015).

There is a close association between obesity and type 2 diabetes. The likelihood and severity of type 2 diabetes are closely linked with body mass index (BMI). There is a seven times greater risk of diabetes in obese people compared to those of healthy weight, with a threefold increase in risk for overweight people. Whilst it is known that body fat distribution is an important determinant of increased risk of diabetes, the precise mechanism of association remains unclear. It is also uncertain why not all people who are obese develop type 2 diabetes and why not all people with type 2 diabetes are obese. (Gatineau, et al 2014), This is reflected in my study results where majority of the participants are either overweight or obese and having those who are normal and underweight.

5.4 Physical exercise and type 2 diabetes mellitus

Physical exercise has been considered as one of the cornerstones in the treatment of diabetes mellitus along with nutrition and medication since from the past 100 years ago (Sigal, Kenny,

Wasserman, Castaneda-Sceppa, 2004). Physical exercise plays a key role in the prevention and management of type 2 diabetes mellitus by increasing energy expenditure and improving action of insulin (Nakhanakhup, Monigmee, Appel, & Duarte, 2006). However it was noted by (Yuzo, 2003), for effective maintenance of blood glucose levels, physical exercise had to be combined with dietary management. Therefore the differences in relationship in my study might have been due to dietary factors.

In a randomized control study carried out in Italy, 25 patients were monitored over a period of 4 months while doing aerobic exercise 3 times a week. Results of this study showed that Aerobic exercise reduces blood glucose concentrations to a greater extent than resistance exercise, and both have higher risk of exercise-induced hypoglycemia (Sukal, et al., 2012). The results in latter study were contrary to the results in my study.

Similarly to my study, it was identified that exercise did not have a significant role on the blood glucose levels of patients in a case control study in Australia (Kriketos, Cooney, Hawley,2004). Several factors influence exercise fuel use, but the most important are the intensity and duration of physical activity (Bajpeyi, et al., 2009).There are a variety of conditions that need to be considered in understanding hypoglycaemia during exercise including the type and duration of exercise, glucose concentrations prior to starting exercise, and the relation of exercise to meals and insulin doses (Yavari, Hajiyev, Naghizadeh, 2010).

5.5 Dietary intake and type 2 diabetes mellitus

The diet-diabetes relationship has received a great deal of scientific attention over the past decades, accompanied by methodological efforts to assess dietary intake accurately (Willett, 1998). High caloric intake increases the risk of type 2 diabetes mellitus (T2DM) by increasing body weight, thus decreasing insulin sensitivity (Parillo, Riccardi, 2004) Refined carbohydrates, which are high in fructose, may increase the risk of T2DM by increasing insulin resistance. International evidence has identified some dietary items, such as whole-grain rich foods, cereal fibre, legumes, and green leafy vegetables that play a protective role against chronic conditions including T2DM (Gross, Li, Ford, Liu, 2004)

Similarly to my study, a cross-sectional study was part of the Negev Nutrition Study in Israel. A random proportional geographic cluster sample of the Negev residence was selected, and a

random adult of each household was chosen to participate in the study. A single modified multi-pass 24-h questionnaire, that was adapted from the United States Department of Agriculture, was used to collect dietary information. Results showed no relationship between dietary intake and type 2 diabetes mellitus (Bilenko, Vardi, Shai, Shahar, 2002).

The study focused on the usual dietary intake of type 2 diabetes patients who were receiving treatment from Jinja regional referral Hospital who had come for routine clinical review.

From the 24 hour recall and food frequency, the patients had extremely high carbohydrate intake. This was shown with the high percentage of the participants consuming cereals and tubers and plantain almost daily. Higher carbohydrate intake was associated with higher BMI. Fat, saturated fat, polyunsaturated fat and fiber were not significantly associated with BMI among patients with type 2 diabetes. (Nicolas M. et al, 2017).

Compared to studies elsewhere, this study has reported the highest consumption from carbohydrate in form of cereals among type 2 diabetic population. This can be explained by the fact that the usual Ugandan diet comprises of starches as the staple foods on the plate, accompanied by small amounts or infrequent sauce/relish which is usually a plant protein, animal protein or a vegetable. This also continues to explain why protein intake by the patients in this study was quite low which is reflected by the intake of meat products and dairy which were very low although optimal. It is also inappropriate to disregard the fact that the fairly low protein intake of the patients may be attributed to the absence or small quantities of protein foods in the diet due to the high cost of these foods amid the low social economic status among the population.

In Uganda, studies to establish the usual dietary intake in terms of nutrient consumption in a type 2 diabetic population are very few which limits lack of literature for comparison.

CHAPTER SIX: LIMITATIONS, CONCLUSIONS AND RECOMMENDATION

6.1 Limitations of the study.

The small sample size of 105 was also a limitation to the study there slight errors in the process greatly affected the results of the study. This could be one of the reasons for lack of a significant relationship between almost all the study variables with type 2 diabetes mellitus.

Inadequate funds were a key limitation of the study. It was very hectic to carry out all the anthropometric measurements alone since finances were not enough to hire labour during the process of carrying equipment and taking weight and height and to administer questionnaires.

6.2 Conclusions

Majority (52.8%) of the participants had their total energy intake less than 1800Kcal per day. People who were mostly had only 3 main meals in a day that was breakfast, lunch and supper. The most consumed food groups were cereals and these were followed by legumes. Fruit consumption among these patients was very low.

There was no relationship between almost all the study variables and type 2 diabetes mellitus. Significant relationships were only identified between marital status, nature of work and type 2 diabetes mellitus. The small sample size was one of the major reasons that were indentified for the lack of significant relationships.

Majority of people had received information on type 2 diabetes mellitus management and this information was given monthly during the routine clinical visits by the patient.

6.3 Recommendations

There should be increased sensitization to the people with Type 2 diabetes mellitus on the dietary management of type 2 diabetes at the health centers. This information can be delivered at least weekly at all health facilities to the patients who come to the check up and treatment and often through the media like television and radio

Health clubs to promote physical exercise should be established by the health facilities in the area as an intervention in the prevention and management of type 2 diabetes mellitus. Most of the respondents noted that the reason why they didn't engage in physical exercise was that they

had no one to exercise with and also considered manual work was enough exercise for them. There group physical exercise sessions would be recommended as a way of encouraging people to engage in physical exercise for example organizing the patients together with healthy people to in participate in jogging and aerobic which can be twice a month to motivate these patients to exercise. They should be sensitized on the importance of exercise.

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APPENDIX
QUESTIONNAIRE

Introduction and consent

Dear Respondent,

I am KIA IMELDA a student from Makerere University pursuing a Bachelor of Science in Human Nutrition and dietetics in my third year carrying out a research to assess weight status and dietary patterns of Type 2 Diabetic Patients. The objective of this study is to determine the relationship between obesity and dietary patterns.

The research is for academic purposes and the information collected will be treated with confidentiality.

Instructions

I will read to you the questions below and please tell me the right answer.

Respondent ID No.

Date.....

SECTION A: SOCIAL-DEMOGRAPHIC DATA

1. Sex

1. Female 2. Male

2. How old are you?

1. 20-30 years 2. 31-40 years 3. 41-50 years 4. 51-65 years

3. What is your level of education?

1. Not educated 2. Primary 3. Secondary 4. Diploma 5. Bachelors degree

6.others specify.....

4. What is your marital status?

1. Married 2. Single 3. widow 4. Widower 5 Others, specify.....

5. What is your religion?

1. Moslem 2. Catholic 3. Anglican 4. Pentecostal 5. Seventh Day Adventist
6. Others, specify.....

6. What nature of work do you do?

1. Manual work 2. Sedentary work

SECTION B: ANTHROPOMETRY

Weight	
Height	
BMI	

SECTION C: LIFESTYLE FACTORS

8. Do you take alcohol?

1. Yes 2. No

9. If yes, how many often a week?

1. 6-7 days a week 2. 3-5 days a week 3. 1-2 days a week 4. Others
specify.....

10. Do you smoke/ use tobacco?

1. Yes 2. No

11. If yes, how often?

1. 6-7 days a week 2. 3-5 days a week 3. 1-2 days a week 4. Others specify.....

12. Do you engage in Physical Exercise?

1. Yes 2. No

13. If yes how often do you exercise?

1.6-7 days a week 2. 3-5 days a week 3. 1-2 days a week 4. Others specify.....

14. What kind of exercise do you engage in?

1. jogging 2.gyming 2. Others specify.....

SECTION D: KNOWLEDGE ON TYPE 2 DIABETES MELLITUS

15. Have you ever tested for Type 2 Diabetes mellitus?

1.Yes No

16. If yes, when was the last time you tested?

1.This month 2. Last month 3. 3 months ago 4. 6 months ago 5. Others specify.....

17. What was the blood Glucose value?

1. Below the Normal 2. Above the Normal

18. Do you receive any information about type 2 diabetes mellitus management?

1. Yes 2. No

19. If yes, how often do you receive this information about type 2 diabetes mellitus management?

1. Daily 2. Weekly 3. Monthly 4. Others specify.

20. From whom do you receive this information?

1. health worker 2. Relative 3. Others specify

SECTION E: DIETARY INTAKE

24-hour dietary recall

Instructions

Please write down all foods and beverages consumed for a period of 24 hours that is starting yesterday at 12:00 am and ending at 11:59 pm.

List the approximate Time the meal was consumed, Place where it was consumed (home, work, name of restaurant, church, etc.), and the type of eating occasion or Meal (breakfast, lunch, dinner, snack, or other).

List each Food/Beverage Item you consumed, including foods eaten between meals and all drinks, even if it is a non-caloric item like water, coffee, tea, as long as you got that food or beverage, put it into the mouth and swallowed it.

Specify Details/Ingredients/Preparation of each food or beverage consumed.

Time	Place	Meal	Food/ Beverage item	Details/ Ingredients/ Preparation	Amount

Food Frequency Questionnaire

What is the frequency of consumption and sources of the following foodstuff in the household?

Food group	> 1 / d	> 1 / w e	1 / w e	>1 / m o n t h	R a r e l y	N e v e r

	a y		e k	e k			
Cereals; maize, maize porridge, millet, millet porridge, rice, wheat products.							
Tubers and plantain; cassava, sweet potatoes, Irish, matooke							
Legumes; Beans, Peas, Groundnuts, soybeans							
Dairy, Fats, oil; milk, margarine, Ghee, cooking oil							
Animal products; meat, pork, poultry, eggs, fish, silver fish							
Vegetables; dark green vegetables, jobyo, tomatoes, pumpkin, carrots							

Fruits; oranges, watermelon, papaya, mangoes, passion fruits, avocado, pineapple, guava							
--	--	--	--	--	--	--	--