



**SCHOOL OF LIFE SCIENCES AND ALLIED HEALTH
DEPARTMENT OF MEDICAL LABORATORY SCIENCE**

**INVESTIGATING THE PREVALENCE OF TYPE 2 DIABETES MELLITUS, RISK FACTORS
AND COMPLICATIONS AT QECH**

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LIST OF ACRONYMS AND ABBREVIATIONS

WHO	World Health Organization
COMREC	College of Medicine Research and Ethics Committee
MLS	Medical Laboratory Science
T2DM	Type 2 Diabetes Mellitus
QECH	Queen Elizabeth Central Hospital
CVD	Cardiovascular Disease

ABSTRACT

Background: Diabetes mellitus is a complex, chronic disease that is characterized by an elevation of the level of glucose in the blood. Insulin, a hormone produced by the pancreas, controls the blood glucose level by regulating the production and storage of glucose. In diabetes there may be a decrease in the body's ability to respond to insulin or a decrease in the insulin produced by the pancreas which leads to abnormalities in the metabolism of carbohydrates, proteins and fats. The resulting hyperglycemia may lead to acute metabolic complications including ketoacidosis and in the long term contribute to chronic micro-vascular complications (Seltzer & Bare 1992:1022). There are four major classifications of diabetes mellitus, namely: Type 1, Type 2, Other types (3) and Gestational diabetes. Type 2 diabetes, by far the most common type of diabetes, is on the rise globally at an alarming rate. It is rapidly escalating into a significant global public health catastrophe that poses a threat to the economies of all countries, particularly poor countries like Malawi. According to current forecasts, the total number of cases in the world could quadruple in the next two decades, resulting in a corresponding increase in the disease's human, social, and economic consequences.

Objective: To assess the prevalence of type II diabetes mellitus, risk factors and its complications at Queen Elizabeth Central Hospital.

Methods: A descriptive cross-sectional and retrospective study was conducted among diabetic patients who were above 45 years old at Queen Elizabeth Central hospital from 8th – 22nd September, 2022. Convenient sampling technique was used to enroll participants. Questionnaires were used to collect socio-demographic characteristics and possible associated risk factors. Weight and height were measured using scale and height board respectively. BP was determined using sphygmomanometer. Data were entered into excel spreadsheet and transferred to SPSS for analysis. Frequency tables and graphs were used to summarize data.

Results: The study enrolled eighty (80) diabetic patients. Out of eighty (80) participants 10% of the participants were pre-hypertensive, 66.3% were hypertensive, 25% were obese, 40% were overweight, 35% had relatives with diabetes, 6% were smokers, and 18% had history of alcohol consumption. The prevalence of complications was positively associated with patients with family history of T2DM ($P=0.033$).

Conclusion: The main complication in this study was high blood pressure and vision impairment and the main risk factor was family history of T2DM. The characteristics of the study population indicate the need to improve clinical follow-up and increase motivation for health behaviors.

1. INTRODUCTION

Diabetes Mellitus is a condition that is characterized by an elevation of the level of glucose in the blood. Insulin, a hormone generated by pancreatic beta cells, regulates glucose production and storage in the blood [1]. Diabetes causes irregularities in glucose, protein, and fat metabolism due to a loss in the body's ability to respond to insulin or a decrease in the amount of insulin generated. Type 2 Diabetes Mellitus is known as non-insulin dependent DM. In type 2 diabetes mellitus there are two problems related to insulin. There is insulin resistance and impaired secretion of insulin by pancreatic beta cells. Insulin resistance refers to the tissues' diminished sensitivity to insulin [2]. Diabetes was initially considered the disease of the affluent society but it is currently affecting people even in the sub-Saharan African regions including Malawi.

Some genetic and environmental factors are associated with this condition. The disease has a very high mortality rate, however, it can be treated and reversed through strict adherence to recommended diet that can reduce hyperglycemia and adequate exercise [3]. A considerable genetic influence in the etiology of type 2 diabetes mellitus has been found in population-based investigations, with a preponderance of maternal transmission being documented [1]. T2DM carriers have a 50% probability of passing the disease on to their children [4].

Diabetes is also a lifestyle-related disease. Obesity, excessive alcohol intake, a sedentary lifestyle, and a lack of exercise are all linked to it. Diet and exercise are used to manage type 2 diabetes, and if excessive glucose levels persist, oral hypoglycemic medications are used to supplement the diet [5].

T2DM can be considered one of the chronic diseases of greater impact for the public health system. Diabetes metabolic control and treatment of its complications have a large cost for health services, in addition to producing a high level of morbidity and death. The study is aimed at assessing the prevalence of this condition and its risk factors and their association with diabetes complications among the ageing population. It is also aimed at determining the association between the condition and environmental factors such as social economic status, obesity, smoking, alcoholism, xenobiotic induced liver disease, cardiovascular problems and endocrine neoplastic. The study will also assess the prevalence of complications such as cardiovascular problems, diabetic retinopathy, diabetic foot and cancers.

1.1 LITERATURE REVIEW

Diabetes mellitus is a chronic non progressive disease that affects glucose regulation. Type 2 is the most prevalent, accounting for more than 90% of all cases [3]. Many researches have proven that diabetes mellitus type 2 is on the rise worldwide, as well as in Sub-Saharan African countries like Malawi. According to the World Health Organization, the global prevalence of diabetes has increased steadily from 108 million in 1980 to nearly four times that number in 2014 [4]. It was found to affect 382 million people in 2013 and was estimated to 482 million by year 2030. Diabetes was anticipated to affect 12.1 million people in Sub-Saharan Africa, with the number expected to rise to 23.9 million by 2030 [2]. Diabetes affected around 463 million people in 2019, with the number expected to rise to 700 million by 2045 [5]. [6]About 90% of patients with diabetes have type 2 diabetes mellitus (T2DM). According to the International Diabetes Federation (IDF) data, poor and middle income nations account for almost 70% of current cases of type 2 diabetes [6].

T2DM complications include cardiovascular disease (CVD), peripheral neuropathy, diabetic foot, stroke, infection, chronic renal failure, and retinopathy. Type 2 diabetes mellitus (DM) and its complications are an increasing challenge to health care systems worldwide [7]. Diabetes increases the chance of mortality from any cause by 1.8 times, including a 2.3-fold increase in the risk of death from vascular causes, but also a significantly higher risk of death from renal illness, liver disease, infections, mental disorders, and cancer [6].

After 15 years of diabetes, approximately 2% of people go blind, and approximately 10% get severe visual impairment [3].T2DM patients have a 20.2 percent absolute risk of major cardiac events, compared to 18.8 percent for non-diabetic patients with coronary artery disease. Diabetes is also known to interfere with the skin's normal function, resulting in brown patches on the skin [8].

The present service delivery system in Malawi is unable to address the DMT2 load in rural regions due to a lack of access to and availability of healthcare in general. People in the surrounding communities have a great need for information regarding glycemic control measures. Unknown diabetic patients also require good living knowledge in order to avoid engaging in harmful behaviors related with diabetes.

1.2 RATIONALE/ JUSTIFICATION

Diabetes is currently one of Malawi's most serious health problems. Type 2 diabetes is becoming more common, and there is a growing awareness of the need for improved management measures to prevent the complications that come with it. For prevention, quick

Diagnosis, and control, it is necessary to know the frequency of the linked factors. Many researches in Malawi try to improve diabetes knowledge and primary health care techniques, but they don't give evidence on the extent to which these factors are linked to the disease. In order to reduce the prevalence of diabetes mellitus, we must first of all know about the prevalence of its risk factors and associated complications. However, detailed population-based data on the prevalence of diabetes risk factors and related complications is limited. In Malawi, just a few epidemiological studies and analyses have been conducted on this topic. To execute the most appropriate screening and preventive programs, a comprehensive assessment of the primary factors of diabetes incidence at the population level is required. This study was therefore carried out to find the prevalence of risk factors of Diabetes Mellitus and their complications in Malawi to provide a novel prospect for future researchers.

1.3 THE OBJECTIVES OF THE STUDY

Broad Objective

To investigate the prevalence of type 2 diabetes mellitus, risk factors and the associated complications.

Specific Objectives

1. To determine the prevalence of type 2 diabetes mellitus
2. To investigate the prevalence of risk factors among T2DM patients and their association with T2DM complications.
3. To identify the number of people who report type 2 diabetes mellitus related complications.

2. METHODOLOGY

2.1 TYPE OF STUDY

This was a descriptive cross-sectional and retrospective study.

2.2 STUDY SITE

The study was conducted at Queen Elizabeth Central Hospital diabetes clinic.

2.3 STUDY POPULATION

The study enrolled diabetic patients who were above 45 years old.

2.4 STUDY PERIOD

The study was conducted within a period of 4 weeks from 8th- 22nd October 2022. All activities were done according to the planned schedule on which participant's recruitment was done during the first three weeks while data analysis and report writing were done in the last 1week.

2.5 SAMPLE SIZE

The study will recruit 80 participants calculated based on single proportional formula at 95% confidence interval, 5.6 estimated prevalence and 5% margin of error. A P value of 5.6% used was derived from previous study on diabetes mellitus conducted in mowing general population.

$$n = \frac{z^2 \times (1 - p)}{d^2}$$

n = number of diabetes patients

d²

z = confidence level (1.96)

d = degree of error (5%)

p = estimated proportion of diabetes (5.6%)

$$\begin{aligned} n &= \frac{1.96^2 \times 0.055(1-0.055)}{0.05^2} \\ &= 80 \end{aligned}$$

2.6 INCLUSION AND EXCLUSION CRITERIA

A. INCLUSION CRITERIA

Participants eligible to participate in this study were individuals based in Blantyre above 45 years of age and have visited the diabetes clinic between 1st January 2021 to 31st November 2022. Most diabetes complications become prominent 10-15 years after diagnosis. Therefore, recruiting participants above 45 years of age assisted in the analysis of the complications.

B. EXCLUSION CRITERIA

The study excluded individuals that were outside Blantyre and those that died before data collection process.

2.7 DATA COLLECTION

A questionnaire was used to collect data from participants. The questionnaire was validated prior to data collection as follows: it was read by two experts to ascertain if the questions really captured what the research intended to achieve. The questionnaires were then piloted on patients and were not used for analysis. All issues that arose from these steps were resolved prior to data collection. The benefits of the study were highlighted during introduction of the study to the participants. Target population were given a chance to ask questions for clarification. Those who had private questions were given room for proper explanation to their queries.

A questionnaire and consent form in both English and Chichewa versions were provided to the participants. The questionnaire and consent form were read to those with writing and reading difficulties. Investigators used a questionnaire to assess possible risk factors and collect demographic data.

Blood Pressure was measured using a sphygmomanometer. An inflatable cuff was being placed round the patient's arm. Then, the cuff was being inflated which was gently tightening the arm of the patient. The cuff has gauge that measures the blood pressure. The reading was being displayed on the sphygmomanometer's screen in millimeter Mercury (mmHg). Blood Pressure was measured to determine the patient's BP status.

Weights of the patients were being measured using a digital scale. Before the weight was measured, the scale calibration was verified to ensure accurate measurements. During scale calibration different objects of known weights were used:

1. The scale was turned on and it read zero.
2. 25 kilograms object (dumbbell) was placed on the scale and verified then recorded.
3. The object was removed from the scale and scale reading went down to zero.

Steps 2 and 3 were repeated for objects weighing 50 kilograms, 75 kilograms and 100 kilograms. The scale accurately read the different weights.

The scale was placed on hard, level floor. Before each measurement, the scale was being zeroed. Patients were being asked to remove heavy outer clothing such as shoes, hooded sweatshirts or jackets. Then, patients were being asked to stand motionless in the middle of the scale platform. Weight was being recorded to the nearest whole number.

Height was measured using height board. When measuring, patients were being asked to stand with heels, buttocks and upper back against the height board. Patients were being asked to stand straight and look straight ahead. The measurements were being taken from the side of the height board at an eye level to the nearest tenth.

Weight and height were used to calculate Body Mass Index (BMI) using the formula:

$$\text{BMI} = \text{Weight}/\text{Height}^2$$

2.8 DATA MANAGEMENT AND ANALYSIS

Participants were assigned different accession numbers to maintain privacy and confidentiality throughout the study period. The data collected were not shared with anyone outside the study team. The questionnaires were cross checked and filed for safety. Results for mass, weight and blood pressure were stored electronically using kobo tool box.

Data collected were entered on excel worksheet and then transferred into SPSS for analysis. Data was summarized in frequency tables showing the demographic variables, possible risk factors and complications of diabetes. Descriptive statistical analysis was used to show socio-demographic characteristics, risk factors and complications by percentage and frequencies.

2.9 ETHICAL CONSIDERATION

The research proposal was reviewed and approved by COMREC () and Medical Laboratory Science Department. Prior to data collection, a research recommendation letter was sought from the QECH Research Ethics Committee and Head of Diabetes Clinic. An approval letter was obtained from the QECH hospital director for the investigators to proceed with the study. All respondents who met the eligibility criteria were given an introduction to the study and taken through the consenting process provided an opportunity to ask questions before providing written consent to participate. Accession numbers were used as IDs instead of participant names to maintain participant confidentiality.

3. RESULTS

A total of 80 participants, who were of the age from 45years, attending diabetes clinic were enrolled in the study. Out of 80 participants, 26 were males while 54 were females and their mean age was 59.15. Those who had attained primary education level constituted 57.4%, 31.3% attained secondary education level and 11.3% attained tertiary education level. All participants reported having attended formal education at either primary, secondary or tertiary. Slightly above half of respondents were not employed formally (full time job) or informally (business and subsistence farming). 55.0% were married, 35.0% were widowed, 6.3% were divorced and 3.7% were single (never married before).

Out of 80 participants, 35.0% had a family history of diabetes, 6.3% had history of smoking and 18.8% had history of alcohol consumption, 25.0% and 40.0% were obese and overweight respectively.

On complications, 62.5% of the respondents had vision impairment, 28.7% had cardiovascular problems, 59.25% of women had operation during labor, 13.8% had leg sores with delayed healing, 66.3% were hypertensive and 10.0% were pre-hypertensive. Socio-demographic and clinical data are summarized in the tables below.

Table 1: socio-demographic characteristics of respondents

	male (n= 26)	female (n=54)	Total (n=80)
education level, n(%)			
primary	11 (13.75)	35(43.75)	46(57.5)
secondary	11 (13.75)	14(17.5)	25(31.3)
tertiary	4 (5)	5(6.25)	9(11.2)
marital status, n(%)			
single	2(2.5)	1(1.25)	3(3.7)
married	20(25)	24(30)	44(55.0)
divorced	0(0)	5(6.25)	5(6.3)
widowed	4(5)	24(30)	28(35.0)
Occupation, n(%)			
Employed	6(7.5)	6(7.5)	12(15.0)
Business	14(17.5)	15(18.75)	29(36.25)
Others	14(17.5)	25(31.25)	39(48.75)

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Figure 1 displays possible risk factors of T2DM among patients attending the diabetes clinic at QECH who were above 45 years. 6.3% had a history of smoking, 18.8% had a history of alcohol consumption while 35% had a family history of diabetes.

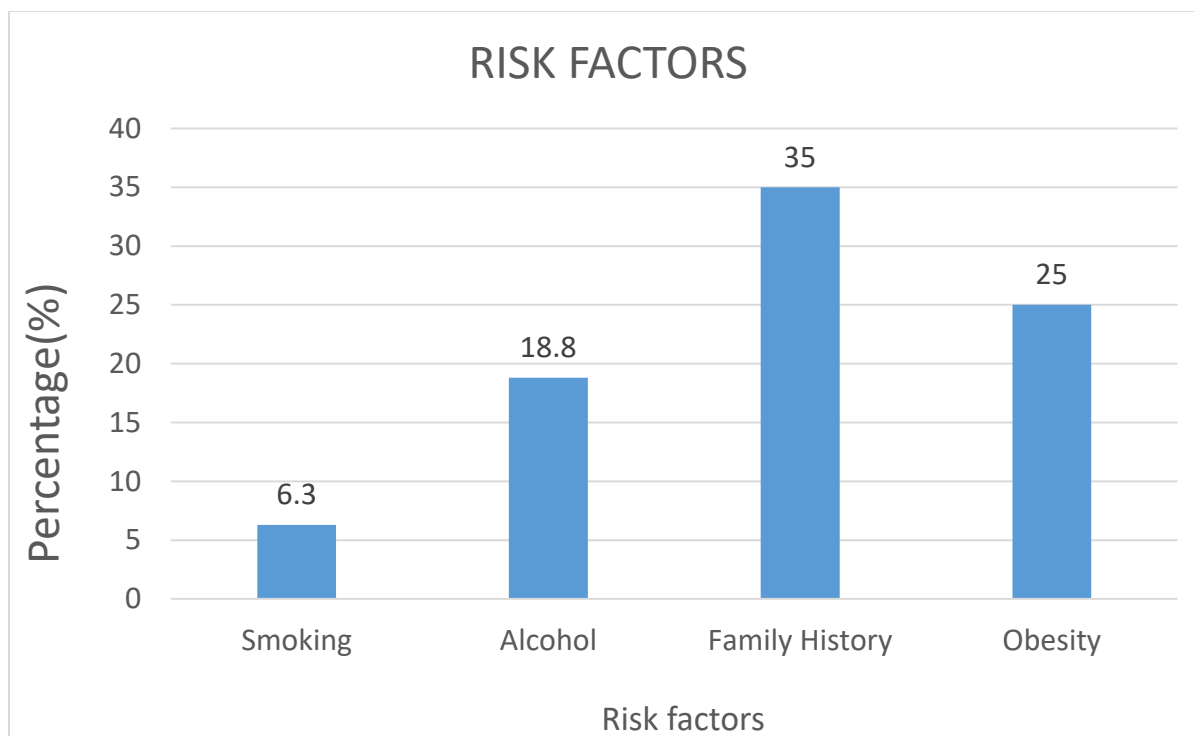


Figure 1: Risk Factors of T2DM among patients attending the diabetes clinic at QECH

Table 2: Body Mass Index

		Frequen cy	Percent	Valid Percent	Cumulative Percent
Valid	underweig ht	2	2.5	2.5	2.5
	normal	26	32.5	32.5	35.0
	overweigh t	32	40.0	40.0	75.0
	obese	20	25.0	25.0	100.0
	Total	80	100.0	100.0	

Table 2 shows that 2.5% of the participants were underweight, 32.5% had normal BMI, 32% were overweight whereas 25% were obese.

Figure 2 shows complications of T2DM which developed after diagnosis of the disease in patients attending the diabetes clinic at QECH of which 62.5% of the participants had vision impairment, 28.7% had cardiovascular problems, 13.8% had delayed healing sores on their feet. 59.25% had a history of operation during labor, 1.25% had an amputated limb(leg), 2.5% had chronic renal failure and 66.3 were hypertensive.

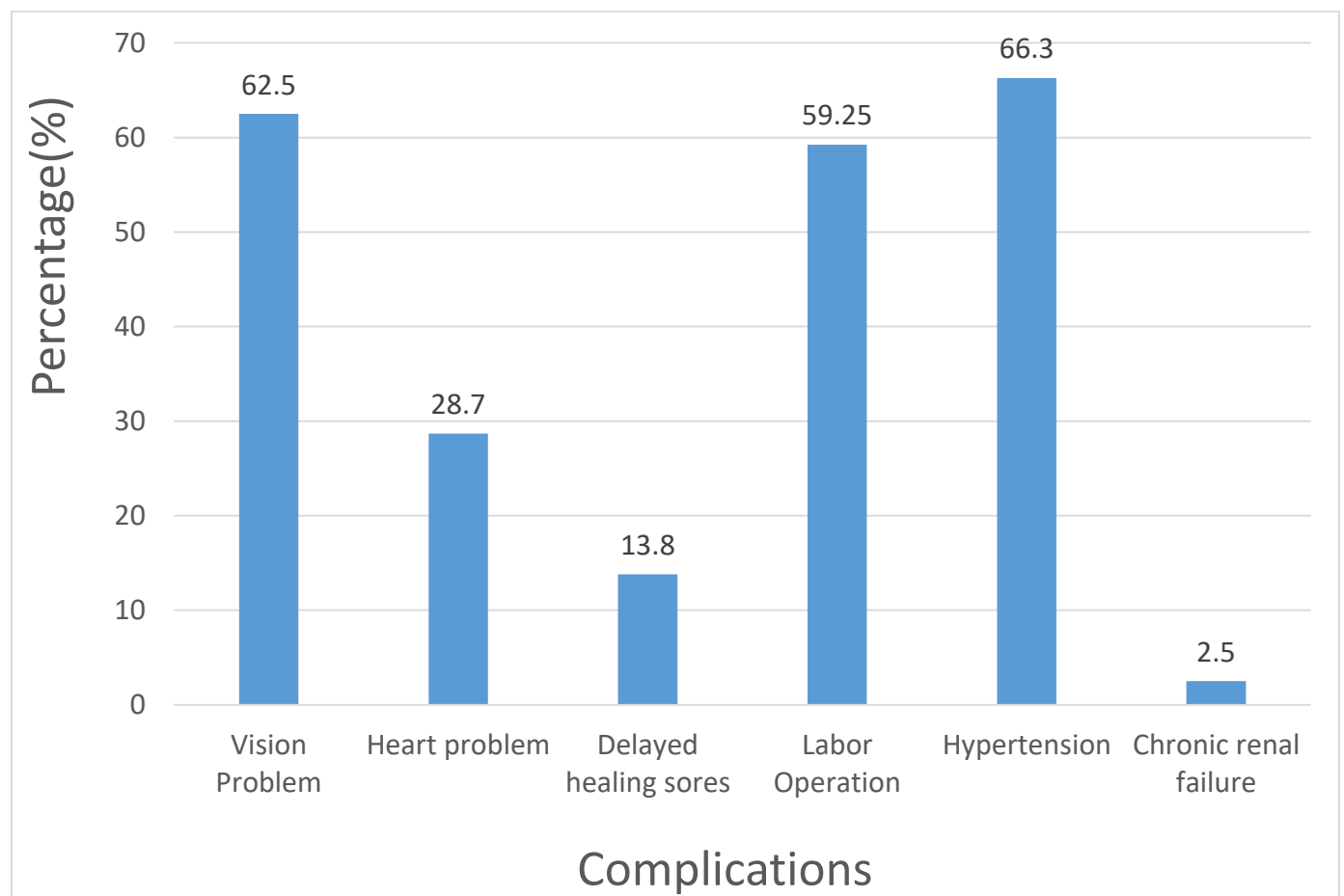


Figure 2: Complications of T2DM among patients attending diabetes clinic at QECH

Blood Pressure

blood pressure measurements indicated that 10.0% of the participants had low blood pressure, 13.8% had normal blood pressure, 10.0% were pre-hypertensive and 66.3% were hypertensive.

Table 3: Blood Pressure Status

Bp Classification		number of patients	percentage	Degree of HTN
Systolic	Diastolic	count		
120-139	60-89	11	13.8	Normal
140-159	90-99	8	10.0	mild
160-179	100-109	8	10.0	moderate
>180	>110	53	66.3	severe

Table 4: Univariate analysis for the factors associated with the presence of high blood pressure in patients with T2DM

HBP n(%)		
Gender		
Male	1(3)	0.709
Female	5(9.2)	
Marital status		
Single	0(0)	0.129
Married	2(4.5)	
Widowed	4(14.2)	
Divorced	0(0)	
Employment		
Yes	2(16.6)	0.268
No	4(5.88)	

Education

Primary	4(8.7)	0.310
Secondary	1(4.0)	
Tertiary	1(11.0)	

Family history

Yes	3(10.7)	0.880
No	3(5.7)	

Smoking

Yes	0(0)	0.101
No	6(8.0)	

Obesity

Yes	4(20)	1.00
No	6(10)	

Table 5: Univariate analysis for the factors associated with the presence of vision impairment in patients with T2DM

Risk Factors	Complications	P Value
Vision impairment n(%)		
Gender		
Male	16(61.5)	1.00
Female	34(62.9)	
Marital status		
Single	2(66.6)	

Married	24(54.5)	0.332
Widowed	3(60.0)	
Divorced	21(75.0)	
Employment		
Yes	9(75.0)	0.268
No	41(60.0)	
Education		
Primary	27(58.7)	0.310
Secondary	16(64.0)	
Tertiary	7(77.7)	
Family history		
Yes	22(78.6)	0.880
No	28(53.8)	
Smoking		
Yes	3(60.0)	0.101
No	47(62.0)	
Obesity		
Yes	12(60.0)	0.726
No	39(65)	

4. DISCUSSION

T2DM and its chronic complications have become increasingly common. Multiple risk factors of diabetes, delayed diagnosis until micro and macro vascular complications rise is also becoming an issue of great concern. Thus, the importance of our study, which contributes to the monitoring of diabetic patients. Monitoring the patients helps to observe what makes the glucose levels go up or down such as eating different foods, being compliant to medication or being physically active. With this information, the patient can work with the health care team to make decisions about their best diabetes care plan. These decisions can help delay or prevent complications such as heart attack, stroke, kidney disease, blindness and amputation.

In this study, we found a higher prevalence of T2DM among married and divorced or widowed respondents compared with single respondents. These findings are consistent with those of Murad et al. Marriage affects lifestyle; couples may increase food intake and become less active after marriage, leading to increased body weight and risk of developing the disease. The prevalence of DMT2 does not show significant association with economic status [9].

In the study, there is high prevalence of diabetes among people who had lower educational attainment. Lower educational attainment result in lower occupational grade leading to lower income attainment. Income, education and occupation show a graded association with diabetes prevalence and complications across all levels of socio-economic status, up to the very top. Those lower on the SES ladder are more likely to develop T2DM, experience more complications, and die sooner than those higher up on the SES ladder. For example, in Malawi people who have low socio-economic status mostly consume high glycaemic index foods that elicit higher glycaemic and insulinaemic responses and promote insulin resistance and type 2 diabetes through beta cell exhaustion.

As for family history, 35% of the patients had first-degree relatives with diabetes, proving a genetic basis for the disease, although their prevalence on the environmental factors cannot be affirmed. This is in consistent with the study by Bommer et al. who found that type 2 diabetes had a hereditary factor from a close family and was associated with gene mutations that are transferred to the genetic line of the family[10]. Although the etiology of T2DM is not fully elucidated, it is known to have a

multifactorial composition. Therefore, it is important to investigate the patient's social history and, if possible, to make the family a pillar of care that involves lifestyle change.

There is an association between obesity and type 2 diabetes. This is evidenced by the high number of obese participants in the study, which was determined by calculating body mass index. BMI is a surrogate index of percentage of body fat mass. It is generally held that excess fat favors the onset of the disease primarily through insulin resistance. In fact, adipose tissue is a pivotal site of insulin resistance and, at the same time, a putative contributor to the pathogenesis of insulin resistance in other tissues, because it releases several molecules that affect the biological action of insulin at the level of liver and skeletal muscle. These molecules include free fatty acid, tumor necrosis factor-, interleukin-6, resistin, adiponectin, and others. Moreover, lipotoxicity has been described in the cell. A study by Zunt et al. suggested BMI as one of the factors that increased the incidence of diabetes in almost all countries [11]. The study findings are also comparable to a report by Bahendeka et al. he reported that personal lifestyle and eating habits which lead to overweightness and obesity were the primary causes of type 2 diabetes [12].

Regarding lifestyle, most patients were non-smokers and non-alcohol-dependent. Measures to prevent hypertension should be part of the treatment of patients with T2DM because it increases the risk of developing cardiovascular diseases, directly impacting morbidity and mortality rates.

The complications included in our study were only those that started after the participants were diagnosed with diabetes.

HBP was the main complication described in our population. The Brazilian Society of Diabetes states that T2DM, hypertension and renal function are closely related [13]. HBP can be both a cause and a consequence of kidney disease, and the combination of the two presents a high risk for cardiovascular disease. Thus, appropriate treatment of HBP helps to prevent cardiovascular disease, minimizes the progression of renal disease and diabetic retinopathy. Care involves practices such as regular physical activity, low-sodium diet, decreased consumption of alcoholic beverages and correct intake of prescribed antihypertensive medication.

According to this study, majority (62.5%) of the diabetic patients were associated with diabetic retinopathy; Diabetes is associated with damage of small blood vessels in retina resulting in loss of vision.

Many female participants were operated during labor, at least once. The labor operation came after they were already diagnosed. During pregnancy, the mother's excess amounts of blood glucose are transferred to the fetus. This causes the baby's body to secrete increased amount of insulin which results in increased tissue and fat deposits. The infant of diabetic mother is often larger than expected for the gestation age leading to difficulties in normal parturition which prompts operation during labor.

The study found that few people had delayed healing sores (diabetic foot), chronic renal failure and amputated limb. Diabetic foot results from both vascular and neurological disease process and often leads to ulceration and subsequent limb amputation. High glucose level damages the nerves and blood vessels in the feet. This causes numbness and loss of feeling in the feet, hence, one cannot feel pain when they have cut, blister or ulcer. The wound is likely to get infected and may not heal well because the damaged blood vessels can cause poor blood flow in the feet. This leads to gangrene, that means the muscle, and skin and other tissues start to die. If the gangrene or ulcer does not get better with treatment the patient may need amputation to prevent the infection from spreading. Poorly controlled diabetes causes damage to blood vessel clusters in the kidney. This can lead to kidney damage and cause high blood pressure which in turn further damage the kidney leading to chronic renal failure.

Since there is no cure for diabetes, its best treatment is primary prevention, encouraging the at-risk population to have healthy lifestyle habits and performing periodic screening. Responsibility for health promotion should not be limited to health professionals. Public policies that need to be implemented include those aimed at improving access to health services, empowering patients to understand the disease and learn self-care skills.

4.1 STUDY LIMITATIONS

- Unwillingness of study participants because previous researchers were giving them money as compensation.
- Some participants were not giving complete information due to their conditions. For instance, participants who had their legs amputated and those on wheelchairs so it was impossible to correctly measure their weight and height for determining BMI.
- Some participants could not remember their date of birth.
- Prevalence was not calculated because of limited resources (both money and time). To calculate prevalence, we needed to take a minimum of four blood

glucose tests and HbA1C test for each participant, which was expensive and impossible to conduct with the available resources.

- Some participants were not able to speak due to illnesses so it was difficult to collect socio-demographic and lifestyle history data from guardians.

5. CONCLUSION

We identified as the main complication in the diabetic population included in our study the incidence of HBP. In addition, we have shown that the main associated risk factors were family history. Measures to prevent hypertension should therefore be part of the treatment of patients with T2DM because it increases the risk of developing cardiovascular diseases, directly impacting morbidity and mortality rates. The prevalence of complications was positively associated with patients with family history of T2DM.

5.1 RECOMMENDATION

We recommend primary prevention actions for this population, such as strict monitoring of blood glucose and blood pressure, multi-professional follow-up, adherence to drug therapy, physical exercise and dietary monitoring, in addition to the active participation of the family in the treatment of the disease and stronger bond with the health unit. However it is reasonable to hypothesize that a multiple target approach might be most effective.

We also recommend basic technologies in primary care facilities such as oral glucose tolerance test, HbA1C, dilated fundus examination, foot vascular status and urine strips for glucose and ketone measurement in order to prevent and control the complications.

6. REFERENCES

1. Overview of Type 2 Diabetes Definition. *Diabetes*. 2002;8–24.
2. Msyamboza KP, Mvula CJ, Kathyola D. Prevalence and correlates of diabetes mellitus in Malawi: Population-based national NCD STEPS survey. *BMC Endocr Disord*. 2014;14:2–7.
3. Hansen WL. Chapter 2: Literature Review. *Regul Theory Its Appl To Trade Policy*. 2018;19–32.
4. Assayed AA, Daitoni I. Primary health care approach to diabetes mellitus in Malawi. *Pan Afr Med J*. 2014;18:2–4.
5. Xia M, Liu K, Feng J, Zheng Z, Xie X. Prevalence and risk factors of type 2 diabetes and prediabetes among 53,288 middle-aged and elderly adults in China: A cross-sectional study. *Diabetes, Metab Syndr Obes Targets Ther*. 2021;14:1975–85.
6. Silva EFF, Ferreira CMM, De Pinho L. Risk factors and complications in type 2 diabetes outpatients. *Rev Assoc Med Bras*. 2017;63(7):621–7.
7. Ulrichsen SP, Mor A, Svensson E, Larsen FB, Thomsen RW. Lifestyle factors associated with type 2 diabetes and use of different glucose-Lowering drugs: Cross-Sectional study. *PLoS One*. 2014;9(11).
8. Kahn SE: The importance of β -cell failure in the development and progression of type 2 diabetes. *J Clin Endocrinol Metab* 86:4047–4058, 2001 54. Kahn BB, Flier JS: Obesity and insulin resistance. *J Clin Invest* 106:473– 481, 2000
9. Murad, M.A.; Abdulmageed, S.S.; Iftikhar, R.; Sagga, B.K. Assessment of the Common Risk Factors Associated with Type 2 Diabetes Mellitus in Jeddah. *Int. J. Endocrinol*. 2014, 2014, 616145.

10. C. Bommer, V. Sagalova, E. Heeseemann et al., "Global economic burden of diabetes in adults: projections from 2015 to 2030," *Diabetes Care*, vol. 41, no. 5, pp. 963–970, 2018.
11. J. R. Zunt, N. J. Kassebaum, N. Blake et al., "Global, regional, and national burden of meningitis, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016," *The Lancet Neurology*, vol. 17, no. 12, pp. 1061–1082, 2018.
12. S. Bahendeka, R. Wesonga, G. Mutungi, J. Muwonge, S. Neema, and D. Guwatudde, "Prevalence and correlates of diabetes mellitus in Uganda: a population-based national survey," *Tropical Medicine and International Health*, vol. 21, no. 3, pp. 405–416, 2019.
13. Zimmet P, Alberti KG, Shaw J. Global and societal implications of the diabetes epidemic. *Nature*. 2001; 414(6865): 782-787. 39.

ANNEX A. INFORMED CONSENT FORM

Purpose of the study

You are being asked to take part in a research study. Before you decide to participate, it is important that you understand why the research is being conducted and what it will involve. Please read the following information carefully and ask the investigator for clarification if need be.

The purpose of the study is to determine the prevalence of diabetes and its risk factors and their association with diabetes complications.

Procedure

The study will involve history taking on past life experiences and medical history. Weight and height measurements will be taken as well. The study will be conducted in a minimum of 5 minutes per participant.

Risks

The participants will not be subjected to any risks

Benefits

There will be no direct benefit to you for your participation. However, the information that will be obtained from this study will help you and the general public through the interventions that will be done through the results obtained from this study.

Confidentiality

The study will use numbers instead of names and the data will be kept confidential

Voluntary participation

Your participation in this study is voluntary. If you have questions about this study you may contact the investigator whose contacts are written on the first page.

Consent

I have read and understood the information provided. I understand that my participation is voluntary and that I am free to withdraw at any time.

Participants signature..... Date.....

Investigator's signature Date.....

INFORMED CONSENT FORM (CHICHEWA VERSION)

Mutu wa kafukufuku

Mlingo wa mtundu wachiwiri wa matenda a shuga, zozetsa matendawa komanso zovuta zina zomwe zimabwera kamba kodwala matendawa pa chipatala chachikulu cha QECH

Cholinga chakafukufuku

Mukufunsiidwa kutenga nawo mbali mu kafukufuku. Musanasankhe kutenga nawo mbali, ndikoyenera kuti mumvetsetse chifukwa chomwe kafukufukuyu akuchitidwira komanso zomwe zidzachitike. Chonde werengani zotsatirazi mosamala ndikufunsa wofufuzayo kuti afotokoze bwino ngati pakufunika kutero.

Cholinga cha kafukufukuyu ndikuona kufalikira kwa matenda a shuga a mtundu wachiwiri, zoopsa zake ndi zovuta zomwe zimabwera kamba kodwala matendawa.

Ndondomeko

Phunziloni lidzaphatikizapo kutenga mbiri ya zochitika zakale za moyo ndi mbiri yachipatala. Kulemera kwa thupi ndi kutalika kuzatengedwanso. Kafukufukuyi adzachitika mphindi zosachepera zisanu pa aliyense wotenga nawo mbali.

Zoopsa zomwe zingathe kuchitika

Otenga nawo mbali sadzakhala pachiopezo chilichonse

Phindu lotenga mbali mkafukufukuyu

Sipadzakhala phindu lachindunji kwa inu chifukwa chotenga nawo mbali. Komabe, zambiri zomwe zingapezeke kuchokera mu kafukufukuyu zidzakuthandizani inu ndi anthu onse kudzera muzotsatira zomwe zapezeka mu kafukufukuyu.

Chinsinsi

Kafukufukuyu agwiritsa ntchito ma nambala mmalo mwa mayina ndipo zonsezi zizasungidwa mwa chinsinsi.

Kutenga mbali mwaufulu

Kutenga mbali mukafukufukuyu ndi mwakufuna kwanu. Ngati muli ndi mafunso okhuza kafukufukuyu funsani wochita kafukufukuyi amene manambala ake alembedwa pa tsamba loyamba

Chilolezo

Ndawerenga ndi kumvetsa zonse zomwe zalembedwa. Ndamvetsa kuti kutenga nawo mbali ndi modzifunira ndipo ndine omasuka kusiya nthawi iliyonse.

Siginecha ya otengenga mbali..... Tsiku.....

Siginecha yawopangitsa kafukufuku..... Tsiku.....

Chidindo cha chala..... Mboni.....

ANNEX B. STUDY QUESTIONNAIRE (ENGLISH VERSION)

Questionnaire to determine the prevalence of type 2 diabetes mellitus, risk factors and associated complications at QECH.

- ☐ Facility Name.....
- ☐ Address
- ☐ Investigator
- ☐ Date

Participants details

- ☐ Participants' phone number.....
- ☐ Residence

I. Socio- demographic information

1. Age
2. Sex
3. Marital status: a. Unmarried b. Married c. widowed d. divorced
4. Occupation: a. employed b. unemployed c. self employed
5. Education level: a. illiterate b. primary education c. secondary education d. tertiary education

II. Participants history of T2DM risk factors

6. do you have a relative with t2dm in our family
7. have you ever smoked
8. have you ever taken alcohol
9. have you been taking oral drugs for a long period of time
10. have you had a surgical procedure in the stomach or uterus

III. participants' medical history of diabetes complications

11. do you experience visual problems from the time you were diagnosed of diabetes

12. do you experience hypertension
13. do you experience heart problems
14. do you experience diabetic foot infection
15. do you experience fertility problems

RESEARCH QUESTIONNAIRE (CHICHEWA VERSION)

Tsatanetsatane wa mafunso wokhuza mlingo wa mtundu wachiwiri wa matenda a shuga komanso zovuta zina zomwe zimabwera kamba kodwala matendawa pa chipatala chachikulu cha QECH.

- ☐ Malo.....
- ☐ Adilesi
- ☐ Wochita kafukufuku.....
- ☐ Tsiku

Mbiri ya wotenga mbali mkafukufuku

- ☐ nambala ya foni.....
- ☐ kochokera.....

1. zokhuzana ndi zachuma ndi moyo wa tsiku ndi tsiku

- a. zaka
- b. jenda
- c. banja
 - i. wosakwatiwa
 - ii. wokwatiwa
 - iii. wamasiye
 - iv. banja linatha
- d. mmmagwira ntchito yanji
 - i. sim'magwira tchito
 - ii. m'magwira ntchito m'boma
 - iii. m'mapanga bizinesi
- e. maphunziro anu ali motani
 - i. munalekezera pulayimale
 - ii. munalekezera sekondale

- iii. munafika ku sukulu ya ukachenjede

2. Mbiri yopanga zinthu zomwe zimapereka chiopsezo chokhala ndi matenda a shuga

- i. M'banja mwanu muli ena omwe amadwala matenda a shuga?
- ii. M'nasutapo?
- iii. M'namwapo mowa?
- iv. Mwakhala mukumwa mankhwala kwa nthawi yayitali?
- v. M'napangapo opaleshoni ya mmimba kapena chibelekero?

3. Mbiri ya zovuta zomwe zimabwera kamba ka matenda a shuga

- i. munakhalapo ndi vuto lamaso?
- ii. M'nakhalapo ndi vuto la mtima?
- iii. M'matuluka zilonda mmiyendo?
- iv. M'makumana ndi mavuto pa nkhani ya kubeleka?

ANNEX C: SUPPORTING LETTER FROM MLS DEPARTMENT

Kamuzu University
of Health Sciences

Private Bag 360,
Chichiri, Blantyre 3.
www.kuhs.ac.mw
+2651 810 911/+2651 811 286

Formerly College of Medicine and Kamuzu College of Nursing.

6 December, 2021

TO WHOM IT MAY CONCERN

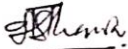
Dear Sir/Madam,

INTRODUCING MEDICAL LABORATORY SCIENCES (MLS) 3 RESEARCH STUDENTS

I write to introduce Bertha Duncan who would like to conduct undergraduate Research entitled *Prevalence of type 2 diabetes mellitus, risk factors and complications at QECH* at your institution under the supervision of Mr Daniel L. Banda.

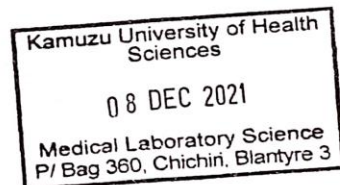
Please assist them accordingly.

Yours faithfully,



Dr. Isaac Thom Shawa,
Head of Medical Laboratory Science Department
Tel: +265 1871911, Ext 262

Email: hodmls@medcol.mw



ANNEX D:SUPPORTING LETTER FROM STUDY SITE AND HOSPITAL DIRECTOR

Telephone: (265)874 333/877 333
Facsimile: (265)876 928
Email: queenshospital@globemw.net

All Communications should be addressed to:
The Hospital Director



In reply please quote No.
QUEEN ELIZABETH CENTRAL HOSPITAL
MINISTRY OF HEALTH
P. O. BOX 95
BLANTYRE
MALAWI

19th April, 2022

The Chairman
Queen Elizabeth Central Hospital Research Committee
P/Bag 95
Blantyre 3

Dear Sir,

PREVALENCE OF TYPE 2 DIABETES MELLITUS, RISK FACTORS AND COMPLICATIONS AT QUEEN ELIZABETH CENTRAL HOSPITAL.

I write to approve the above-stated research project, which aims at evaluating the prevalence of type 2 diabetes mellitus at Queen Elizabeth Central Hospital.

The requirements for this project are that the study team adheres to the research protocol. The study team should bring any changes to the protocol to our attention and Queen Elizabeth Hospital Research Committee.

I wish the study team all the best as they conduct their work.

Yours faithfully,

A handwritten signature in blue ink, appearing to read 'Dr. Chimota Phiri'.

Dr Chimota Phiri
Head of Medicine

elephone:(265)874 333/877 333

Facsimile:(265)874 603

Email:queenshospital@malawi.net

All Communications should be addressed to:

The Hospital Director



In reply please quote No.

QUEEN ELIZABETH CENTRAL HOSPITAL

MINISTRY OF HEALTH

P.O.BOX 95

BLANTYRE

MALAWI

1 April 2022

The Chairperson

College of Medicine Research and Ethics Committee

College of Medicine

Private Bag 360

Chichiri

Blantyre 3

Dear Sir.

PREVALENCE OF TYPE 2 DIABETES MELLITUS, RISK FACTORS AND COMPLICATIONS AT QECH

I write to support the conduct of the above research activity in this hospital by Ms Bertha Duncan and her team. Their study will determine the prevalence of type 2 diabetes and risk factors for developing diabetes in patients with diabetes.

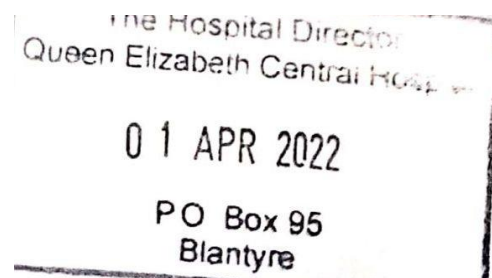
We request that the findings of the study be made available to our Hospital Research Committee and the relevant department in this hospital.

We wish the study team success.

Yours faithfully

Dr S Mndolo

Acting Hospital Director



ANNEX E: CERTIFICATE OF APPROVAL FROM COMREC



**CERTIFICATE OF ETHICS
APPROVAL**

This is to certify that the College of Medicine Research and Ethics
Committee (COMREC) has reviewed and approved a study entitled:

P.05/22/3622 - Prevalence of type 2 diabetes, risk factors and complications at Queen
Elizabeth Central Hospital by Bertha Duncan

On 17-Aug-22

*As you proceed with the implementation of your study, we would like you to adhere to international ethical
guidelines, national guidelines and all requirements by COMREC some of which are indicated on the next page for
your study*


Prof. E. Umar -Chairperson (COMREC)

17-Aug-22
Date

Approved by
College of Medicine
17-Aug-2022
(COMREC)
Research and Ethics Committee

