Review Article
Volume 6:4, 2022

Journal of Clinical Research

ISSN: 2795-6172 Open Access

Factors Associated with Poor Glycemic Control Among Patients with Diabetes Mellitus Attending out-Patient Clinic at Ndola Teaching Hospital, Ndola, Zambia

Maggie Chikondo*

Department of Medicine and Surgery, Copperbelt University, Kitwe, Zambia

Abstract

Introduction: Diabetes mellitus, a metabolic disease characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action or both. It is one of the most common non communicable diseases in Zambia and there is no cure for it. Diabetes Mellitus (DM) is one of the major causes of morbidity and mortality among the non-communicable diseases worldwide. These are highly associated with a poor glycaemic controls. Hence, this study aimed at determining the factors associated with poor glycaemic control among diabetes mellitus outpatient at the Ndola Teaching Hospital, Ndola Zambia

Objectives: The main goal of this study is to determine or identify factors associated with poor glycaemic control among diabetes mellitus out patients at Ndola Teaching Hospital in Ndola.

Methodology: A hospital based cross sectional study with convenient random sampling was conducted on a total number of 92 participants. Data was collected through an interview using a questionnaire during hospital visits. The data was then analysed using SPSS V23. The prevalence of poor glycaemic control was calculated and the factors associated with it were deduced using *chi square* test.

Results: The factors significantly associated with poor glycemic control were lack of physical exercise, use of non-insulin medication, smoking and dyslipidaemia. Those who had regular blood sugar testing, following the recommended and attending the follow up meeting with the health care provider were less likely to have poor glycemic control so as those who did physical exercises.

Conclusion: Lack of physical exercises, not testing blood sugars regularly, dyslipidaemia and smoking were found to be associated with poor glycemic control. Staff managing DM patients should emphasize and include information education and communication sessions during the follow-up visits by DM patients on frequent monitoring of blood glucose levels, regular physical exercises and avoid smoking.

Keywords: Diastolic blood pressure • Body mass index • Systolic blood pressure

Abbreviations: ADA: American Diabetes Association; AOR: Adjusted Odds Ratio; BMI: Body Mass Index; CI: Confidence Interval; DAZ: Diabetes Association of Zambia; DBP: Diastolic Blood Pressure; DKA: Diabetic Ketoacidosis; DM: Diabetes Mellitus; FBS: Fasting Blood Sugar; HONK: Hyperglycaemic Non Ketotic; ICU: Intensive Care Unit; SBGM: Self Blood Glucose Monitoring; SBP: Systolic Blood Pressure; TDRC: Tropical Disease Research Centre; NTH: Ndola Teaching Hospital; WHO: World Health Organisation

***Address to Correspondence:** Maggie Chikondo, Department of Medicine and Surgery, Copperbelt University, Kitwe, Zambia, Tel: 260979000000; E-mail: maggiechikondo@gmail.com*

Received: 07 May, 2022, Manuscript No. JCRE-22-63115; **Editor assigned:** 10 May, 2022, Pre QC No. JCRE-22-63115 (PQ); **Reviewed:** 25 May, 2022, QC No. JCRE-22-63115; **Revised:** 08 July, 2022, Manuscript No. JCRE-22-63115 (R); **Published:** 15 July, 2022, DOI: 10.37421/2795-6172.2022.6.163

Introduction

Background information

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action or both [1]. The chronic hyperglycaemia of diabetes is associated with both short term complications such as Diabetic Ketoacidosis (DKA), Hyperglycaemic Non Ketoacidosis (HONK), long term damage and failure of different organs especially the eyes, kidneys, nerves, heart and blood vessels [2]. Diabetes mellitus is associated with environmental and genetic factors and is one of the major causes of premature illness and death worldwide[3,4]. Recently compiled data shows that approximately 150 million people worldwide have diabetes and that this number may well double by 2025 and much of this increase will occur in developing countries due to population growth, ageing, unhealthy diets, obesity (high BMI) and sedentary lifestyles.

The major cause of morbidity and mortality in Diabetic patients is the complications (American Diabetic Society, 2018); both short and long term and these are as a result of poor glycaemic control among these patients. However, not much information has been gathered to ascertain some of the factors that are associated with poor glycemic control among patients with diabetes. Poor drug adherence and efficacy of prescribed drugs has been well documented as the causes of poor glycaemic control [5]. However cases of poor glycaemic control are still on the rise even in patients who are compliant to their medication and also using the most effective and potent hypoglycemic agents [6]. This therefore indicates that other factors play a huge role in the causation of poor glycaemic control and it is very imperative to establish some of them.

The world health organization estimates that diabetes was the seventh leading cause of death in 2016 [7]. The deaths are as result of complications which are in turn due to poor control of sugar levels among diabetics. Globally a number of studies have been conducted to establish the reasons for this poor glycaemic control. On adherence, Insulin monotherapy and alcohol consumption are predictors of poor glycaemic control [8]. Sex is also another factor that was attributed to poor glycaemic control as women with DM had worse glycaemic control than men [9]. Regionally a majority of patients with diabetes have suboptimal medication adherence due to poor family support, not being able to afford medication and poor healthcare provider patient communication [10]. HIV infection and treatment also have an impact on the glycaemic control as both of these factors negatively affect treatment outcomes [11]. Patients who are consistently monitoring their glucose levels achieved good glycaemic control while those who do not showed poor glycaemic control [12]. Locally not much information is available on how has been done with regards to this subject. However there was evidence of poor glycaemic in the study population according to Musenge et al, but reasons for this were not explored. Another study by Musenge, et al showed poor adherence as a predictor of poor glycaemic control.

While a number of studies have been documented elsewhere, there have been limited known studies in the Zambian population. Zambia has not been spared from this rise in the number of cases of diabetes mellitus as almost all health facilities treat over 30 patients weekly with diabetes. A number of studies conducted showed variable results and most of the attributed poor glycaemic control to non-adherence of patients to their hypoglycemic agent's regimen. Despite all these efforts and improvements in patient compliance to their treatment, complications of diabetes are still on the rise, therefore there is need to probe more on some of the factors associated with poor glycaemic control. Establishment of these factors will help in reducing the cost of treating the complications of diabetes and will establish the prevalence of poor glycaemic control among diabetic patients at the Ndola Teaching Hospital in Ndola, Zambia.

Problem statement

There has been an increase in the prevalence of non-communicable diseases worldwide. Among the non-communicable disease on the rise is Diabetes mellitus and because of its poor control, patients present with complications such as Diabetic foot ulcers, cardiovascular diseases, hypertension, diabetic eye (Retinopathy), stroke, renal failure, immuno suppression, neuropathy and increase in sudden intrauterine foetal deaths due to maternal diabetes. Management of these complications has caused a burden and financial strain on both the patients and the health sector: for example, management of renal failure on dialysis and additional therapy if possible ICU admission which takes up large amounts of money, hospital facility and health personnel to just manage a few patients. Patients with diabetic foot have gone through amputation which has resulted in depression and psychological trauma to them. Some factors associated with poor glycaemic control in DM out-patients at NTH have not been well established as such it is important to identify them. However, little is actually known about the factors that are associated with poor glycaemic control among patients with diabetes [13]. Poor glycaemic control in diabetic patients refers to glycosylated Haemoglobin (HbA1c) levels greater than 48 mmol/l or greater than 7% over three months or fasting blood glucose levels of >130 mg/dl (>7.1 mmol/l) for an average of three months before severe complications occur [14].

Rationale

In the researcher's one-year experience at NTH, as a clinical student, it was observed that diabetes mellitus is one of the commonest non communicable diseases seen at NTH and the whole country at large. There is no cure for DM hence establishing factors associated with poor glycaemic control is very important to prevent complications and deaths. Although a number of studies have been carried out worldwide on the factors associated with poor glycaemic control in diabetic patients. There is still a greater increase in poor glycaemic control in diabetic patients resulting in complications that require a lot of resources to manage. Much of the studies done in Zambia particularly have not focused on factors associated with poor glycaemic control. Although the study has been conducted before at UTH, it is important to go on with this study to address some of the factors which were overlooked and compare the results to see which factors are contributing to the poor glycaemic control. The results collected in this study would suggest some of the factors associated with poor glycaemic control and maybe of use in improving management and control of glycaemia at NTH in Ndola, Zambia.

Conceptual framework

The Figure 1 below shows how socio-demographic factors, lifestyle and clinical factors directly or indirectly lead to poor glycaemic control.

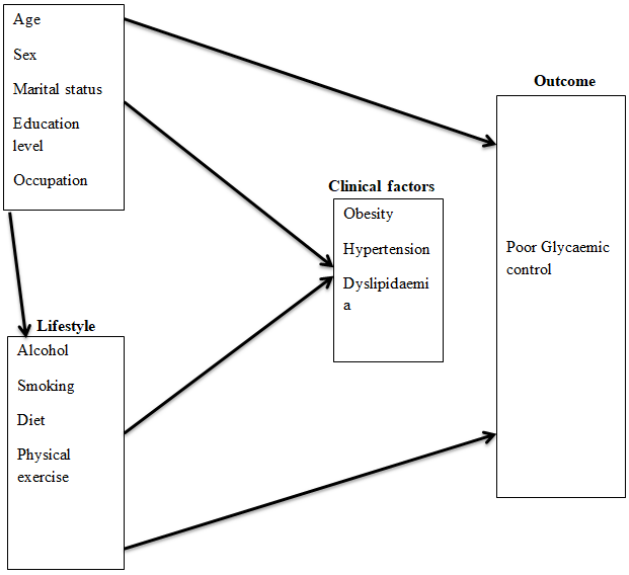

Figure 1. The conceptual framework of factors that may directly or indirectly be associated with poor glycaemic control.

Significance of study

Diabetes mellitus is one of the most common non communicable diseases in Zambia and there is no cure for it. Patients are therefore subjected to lifelong therapy and measures to control the disease. A number of studies have been conducted before on the disease but it is very important to conduct this study at NTH, since this place receives cases not only from within Ndola but also from other parts of the country. The study will therefore give an overview of factors associated with poor glycaemic control in Zambia overall.

Research question

- What are the factors associated with poor glycaemic control among diabetic out patients attending clinic?
- Is there an association between education level and poor glycaemic control?
- Is there an association between alcohol consumption and poor glycaemic control?
- Is there an association between physical exercise and poor glycaemic control?
- Is there an association between co-morbidities and poor glycaemic control?

Objectives

General objectives/aim: To identify factors associated with poor glycaemic control among diabetes mellitus out patients at Ndola Teaching Hospital.

Specific objectives

- To determine the prevalence of poor glycaemic control at NTH
- To determine the association of education level with poor glycaemic control
- To determine the association of alcohol consumption with poor glycaemic control
- To determine the association of co morbidities with poor glycaemic control
- To determine the association of physical exercise with poor glycaemic control

Literature Review

Recently compiled data shows that approximately 150 million people have diabetes mellitus worldwide, and that this number may well double by the year 2025. This shows how much of a burden this condition is to the general population. In the United States of America, the estimated prevalence of diabetes mellitus is between 4.4-17.9%. While diabetes has a major impact on quality of life and economics, the associated vascular complications result in approximately 14% of the expenses of the United States of America [15]. This shows that despite advancements in the management of diabetes by means of hypoglycaemic agents and insulin, a lot of people still go on to develop complications which may be due to poor glycaemic control and therefore it is imperative to establish some of these factors which may be associated with this.

According to Ghanzanifari, et al. in the USA there is no association between sex, BMI, co-morbidity, exercise, age, SBGM, duration of DM, Diastolic Blood Pressure (DBP) and glycaemic control status of the patients. However, other previous studies have found an association between age, duration or DM, SBGM and education and glycaemic control status. The effectiveness of drug treatment depends primarily on the efficacy of the prescribed treatment regimen and adherence to the anti-diabetic treatment by the patient [16-18]. It is not surprising that diabetic patients who fail to comply with the prescribed anti diabetic treatment regimen show very poor outcomes [19].

According Ahmad, et al. in Malaysia and Cur Kendal, et al. in the USA showed that, among the patients who did not adhere to anti-diabetic treatment, most of them had poor glycaemic control while less than half had good glycaemic control status. However, more than half of those who adhered to treatment had poor glycaemic control while less than half had good glycaemic control status. On the contrary, in France reported good glycaemic control status being associated with adherence to anti-diabetic treatment. A pharmacist in Hong Kong managed clinic for diabetic patients and improved adherence and glycaemic control without any change in medication or dosage [20,21]. Suggestions have been made to put greater effort in counselling and improving adherence rather than changing medication or altering the dose [22].

Ahmad, et al reported that, improvement of adherence among patients' results in better glycaemic control, and that achievement of good glycaemic control was higher among adherent patients than among non-adherent patients. However, non-adherence is multifactorial and might include cost, health belief, dosing frequency, personality disorders and patient-provider relationship [23]. The achievement of optimal glycaemic control through strict adherence to anti-diabetic treatment among other factors reduces serious long term complications of DM [24]. If adherence could be resolved, it is

possible that the outcome of treatment would be much more satisfactory among DM patient.

Regionally, according to Gill, et al in remote North Africa conducted a prospective cohort study to accurately assess glycaemic control and the burden of complications. It was concluded that in severely resource-limited area of North Africa, glycaemic control amongst diabetic patients was very poor. The cause for this was attributed to scattered populations, shortage of drugs and insulin and lack of diabetes team care. In this study other possible explanations to poor glycaemic control and high incidence of complication were not tackled or addressed.

Mbeza and Muaka conducted a cross sectional study of diabetic patients in Congo DR and Gabon to establish some of the risk factors of poor glycaemic control. The conclusion drawn from this was that availability of insulin, correct diabetes care, as well as control of HbA1c, glycaemia, hypertension and underweight is urgently needed to slow the onset of complications. Sex and physical exercise were not considered in this study.

Erasmus, et al. in South Africa conducted an assessment of glycaemic control in patients attending a peri-urban clinic. The results suggested that glycaemic control was poor irrespective of sex, duration, BMI, educational status, dietary advice and type of treatment with recommended target values not being achieved in the majority of patients. However these results are not a representation of the overall picture as the study was conducted on a limited number of people concealed to one location therefore more studies exploring age, sex, education level, co-morbidities, acohol consumption and physical exercise need to be conducted.

Locally, a cross sectional study conducted by Musenge, et al. on glycemic control in diabetic patients in Lusaka, at UTH revealed that out of 198 diabetic patients involved in the survey,61.3% of the them had poor glycaemic control. Therefore there was need to explore reasons for this. Association of Insulin, SBP and FBS with glycaemic control further suggests the efficiency of traditional basic monitoring parameters which should be exploited.

Another study conducted by Musenge, et al. on glycemic control and associated self-management behaviors in diabetic outpatients at UTH, Lusaka, Zambia showed that poor adherence to anti-diabetic medication among diabetic patients attending regular medical review was significantly associated with poor glycemic control. However, poor glycemic control was not associated with age, sex, education level, exercise and BMI.

Methodology

Study design

This was a cross sectional study which was conducted among Diabetic outpatients attending clinic at Ndola Teaching Hospital.

Study setting

The study was conducted at Ndola Teaching Hospital in Ndola, Zambia.

Target population

The study included diabetic patients who Visited Ndola Teaching Hospital outpatient clinic during the period of data collection.

Inclusion criteria

- Diabetes mellitus patients attending outpatient clinics at NTH.
- Diabetes mellitus patients aged 18 years old and above.
- Diabetes mellitus patients who will give consent.

Exclusion criteria

- Newly diagnosed diabetes mellitus patients
- Pregnant women
- Very ill patients
- Mentally ill patients

Sample size

The sample size was calculated using the formula $n=Z^2xp(1-p)/d^2$

Where n is the sample size, Z is the confidence level (z-score), P is the estimated proportion and d is the desired precision.

Z=1.96, p=50% or 0.5 (prevalence of poor glycaemic control is unknown, therefore it been estimated at 50%) and d=0.05

Therefore, the sample size total gives a value of 384.

Sampling procedure

Convenient sampling was used during the study. Convenient sampling is a non-probability sampling method which involves study units available at the time of research. Therefore patients who were attending clinic during the data collection period and willing to participate in the study were selected.

Ethical consideration

The authority to conduct the research was obtained from the Copperbelt University Michael Chilufya School of Medicine and the Copperbelt University School Management. The participants were explained to in details about the study and a written consent was be used to seek their participation. The consent was verbally translated into the language that enables the participants to understand the purpose of the study. To ensure confidentiality, patients' names were not captured during data collection and data collected was not used for other purpose than that specified in the study protocol.

Due to COVID-19 pandemic, all the participants were required to wear a facemask and maintain one meter apart from each other as well as those that were individually interviewed.

Data collection

The data was collected from diabetic patients attending outpatient clinic at NTH through an interview using a questionnaire. To identify cases, the results of FBS were obtained from patient's records in the hospital file and also in books where some patient's record their results for self-monitoring blood sugar. Results of HbA1C were available and were used as well. Consent forms were given to patients and those who signed were interviewed in private.

Presentation of findings

The chapter describes in detail the results of our research. The results are in two parts. The preliminary results which involve frequency distribution of sociodemographic and clinical characteristics of patients. Second, the test of association between diabetes with some of our variables in the data.

Socio-demographic characteristics

A total of 92 people were interviewed, one corresponding to each patient, 56.5% (n=52) were females and 43.5% (n=40) were males. In terms of occupation, the majority (50%; n=46) of the respondents were unemployed, while 46.7% (n=43) were employed. In terms of education, the majority (62%; n=57) of the respondents had each attained secondary level, while 34.9% (n=32) attained tertiary level. The remaining 3.3% (n=3) of the respondents attained primary. On marital status, 70.7% of the respondents were married while 10.9% were widowed (Table 1).

Socio-demographic characteristics (n=92)	Categories	Count	Percent
Gender	Male	40	43.5
	Female	52	56.5
Occupation	Employed	43	46.7
	Unemployed	46	50
	No response	3	3.3
Education	Primary	3	3.3
	Secondary	57	62
	College/university	31	33.7
	No education	1	1.1
Marital status	Single	12	13
	Married	65	70.7
	Divorced	5	5.4
	Widowed	10	10.9

Table 1. Socio-demographic characteristics of the respondents.

The age of the participants ranged from 18 to 86 years. The majority of the respondents aged between 31 and 40 and 51-60 (18.5%), respectively. Approximately 8.7% of the respondents aged between 71 and above, while 5.4% were below the age of 20 (Figure 2).

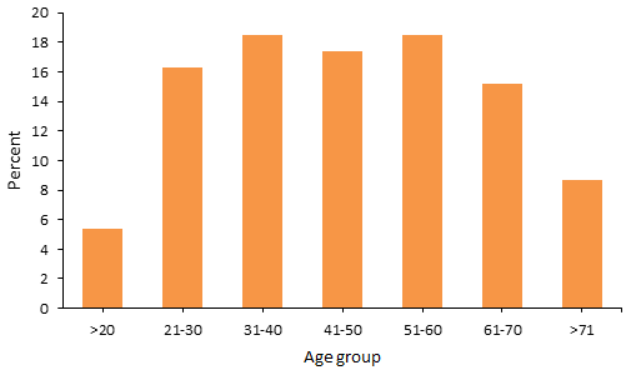

Figure 2. The age group of the respondents.

Self-management behavior

Table 2 shows self-management behavior of the respondents. The prevalence of smoking and alcohol, respectively, was 15.2% and 23.9%. Regarding diabetic medications, 60.9% of the respondents were taking oral medication only followed by insulin (39.1%), None of the participants were on combination therapy. About 81.5% of the respondents had adherence to the treatment while 18.5 had non-adherence. Only 10.9% of the respondents were taking traditional medication while 90.2% of were following the recommended diet. Thirty-eight percent of the patients were making physical exercise and 55.4% follow up of the diabetic clinic. Further, great majority of the respondents had not been testing their blood sugar regularly (63%).

Clinical characteristics (n=92)	Category	Count	Percent
Alcohol drinking	Drinker	22	23.9

	Non-drinker	70	76.1
Habit of smoking	Smoker	14	15.2
	Non-smoker	78	84.8
Anti-diabetics	Insulin	36	39.1
	Oral medication	56	60.9
Adhere to antidiabetic treatment	Yes	75	81.5
	No	17	18.5
Traditional medicine	Yes	10	10.9
	No	82	89.1
Recommended diet	Yes	83	90.2
	No	9	9.8
Make physical exercise	Yes	35	38
	No	57	62
Reviews/follow up of diabetic clinic	Yes	51	55.4
	No	41	44.6
Test blood sugar	Yes	34	37
	No	58	63

Table 2. Self-management behavior.

Clinical characteristics of respondents

The most frequent comorbidity observed over T2DM was HTN 41 (40.6%) and then followed by renal disease and dyslipidemia with 5 and 3 patients respectively. In 47 (46.1%) of the study participants, there was no recorded comorbidity (Figure 3).

The most frequent comorbidity observed over the patient was hypertension (73%) followed by dyslipidemia with 17.8%.

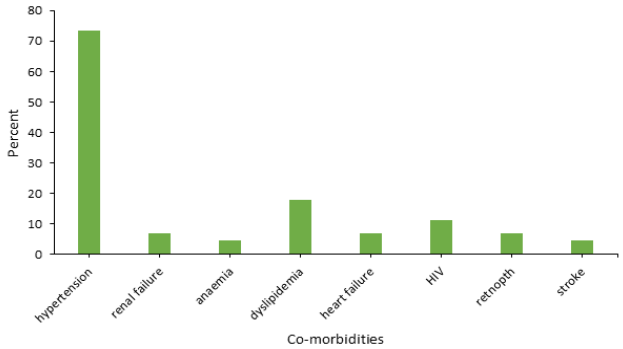

Figure 3. The co-morbidities of respondents.

Anti-diabetic drugs pattern

Overall, 56.5% of female and 43.5% of male were on a different type of antidiabetic medications. Oral antidiabetic prescription was the most frequent one with almost 28% male and 33% female patient distribution. Only fourteen (15.2%) male patients were identified taking insulin injection and relatively high number of female patient (23.2%) was taking insulin compared to male patient. Considering age category, most of the antidiabetic prescription (18.5%) was prescribed for age in between 31-40 and 51-60, respectively. And it was this age group (51-60) that was taking most of the oral medication prescription (14.1%). Fourteen percent of the study participants were taking insulin injection were in between 21 and 30 years (Table 3).

Variables	Insulin (%)	Oral medication (%)	Combination (insulin and oral med)	Total (%)
Sex				
Female	22 (23.91)	30 (32.61)	0 (0.00)	52 (56.5)
Male	14 (15.22)	26 (28.26)	0 (0.00)	40 (43.5)

Age				
<20	4 (4.35)	1 (1.09)	0 (0.00)	5 (5.4)
21-30	13 (14.13)	2 (2.17)	0 (0.00)	15 (16.3)
31-40	6 (6.52)	11 (11.96)	0 (0.00)	17 (18.5)
41-50	4 (4.35)	12 (13.04)	0 (0.00)	16 (17.4)
51-60	4 (4.35)	13 (14.13)	0 (0.00)	17 (18.5)
61-70	2 (2.17)	12 (13.04)	0 (0.00)	14 (15.2)
71+	3 (3.26)	5 (5.44)	0 (0.00)	8 (8.7)

Table 3. Age, sex and antidiabetic drugs distribution at NTH.

Glycemic control level and its contributing factors among patient

Out of the 92 patient enrolled for the study, 43.5% (n=40) had uncontrolled or poor glycemic control while 56.5% (n=52) of the patient had controlled. Table 4 shows the proportion of patients with poor glycemic according to sociodemographic and clinical characteristics. In our study diabetes was more likely to be poorly controlled among patients with any co-morbidity.

Results in this study showed that dyslipidemia had a strong (p=0.01) association with poor glycemic control while other comorbidities such as hypertension, anaemia, HIV, stroke, renal failure and heart failure showed little or no association with poor glycemic control. Further, self-management behaviour such as regular testing blood sugar level (p=0.00), physical exercise (p=0.000), recommended diet (0.004), doctors reviews (0.000) had a strong relationship with glycemic control respectively.

Variable	**Glycemic level**		**Total**	**P value *Chi square***
	Controlled DM 56.5% (52)	**Uncontrolled DM 43.5% (40)**		
Gender				
Male	26.1% 24	17.4% 16	43.5% 40	0.555
Female	30.4% 28	26.1% 24	56.5% 52	
Age				
>20	3.3% (3)	2.2% (2)	5.4% (5)	0.434
21-30	9.8% (9)	6.5% (6)	16.3% (15)	
31-40	9.8% (9)	8.7% (8)	18.5% (17)	
41-50	7.6% (7)	9.8% (9)	17.4% (16)	
51-60	12.0% (11)	6.5% (6)	18.5% (17)	
61-70	6.5% (6)	8.7% (8)	15.2% (14)	
>71	7.6% (7)	1.1% (1)	8.7% (8)	
Alcohol drinking				
Yes	10.9% 10	13.0% 12	23.9% 22	0.23
No	45.7% 42	30.4% 28	76.1% 70	
Smoking				
Yes	4.3% 4	10.9% 10	15.2% 14	0.022
No	52.2% 48	32.6% 30	84.8% 78	
Traditional med				
Yes	8.7% 8	2.2% 2	10.9% 10	0.113
No	47.8% 44	41.3% 38	89.1% 82	

Hypertension				
Yes	17.4% 16	18.5% 17	35.9% 33	0.245
No	39.1% 36	25.0% 23	64.1% 59	
Anaemia				
Yes	1.1% 1	1.1% 1	2.2% 2	0.851
No	55.4% 51	42.4% 39	97.8% 90	
Dyslipidemia				
Yes	0.0% 0	8.7% 8	8.7% 8	0.001
No	56.5% 52	34.8% 32	91.3% 84	
Renal failure				
Yes	2.2% 2	1.1% 1	3.3% 3	0.719
No	54.3% 50	42.4% 39	96.7% 89	
Heart failure				
Yes	1.1% 1	2.2% 2	3.3% 3	0.41
No	55.4% 51	41.3% 38		
HIV				
Yes	2.2% 2	3.3% 3	5.4% 5	0.443
No	54.3% 50	40.2% 37	94.6% 87	
Retinopathy				
Yes	1.1% 1	2.2% 2	3.3% 3	0.41
No	55.4% 51	41.3% 38	96.7% 89	
Stroke				
Yes	0.0% 0	2.2% 2	2.2% 2	0.103
No	56.5% 52	41.3% 38	97.8% 90	
Occupation				
Employed	30.4% 28	16.3% 15	46.7% 43	0.242
Unemployed	23.9% 22	26.1% 24	50.0% 46	
-	2.2% 2	1.1% 1	3.3% 3	
Marital status				
Single	9.8% 9	3.3% 3	13.0% 12	0.294
Married	35.9% 33	34.8% 32	70.1% 65	
Divorced	4.3% 4	1.1% 1	5.4% 5	
Widowed	6.5% 6	4.3% 4	10.9% 10	
Test sugar level				
Yes	31.5% 29	5.4% 5	37.0% 34	0
No	25.0% 23	38.0% 35	63.0% 58	
Exercise				
Yes	35.9% 33	2.2% 2	38.0% 35	0
No	20.7% 19	41.3% 38	62.0% 57	

Review				
Yes	46.7% 43	8.7% 8	55.4% 51	0
No	9.8% 9	34.8% 32	44.6% 41	
Recommended diet				
Yes	55.4% 51	34.8% 32	90.2% 83	0.004
No	1.1% 1	8.7% 8	9.8% 9	
Adherent				
Yes	55.4% 51	26.1% 24	81.5% 75	0
No	1.1% 1	17.4% 16	18.5% 17	
Insulin				
Yes	27.2% 25	12.0% 11	39.1% 36	0.045
No	29.3% 27	31.5% 29	60.9% 56	
Oral drug				
Yes	29.3% 27	31.5% 29	60.9% 56	0.045
No	27.2% 25	12.0% 11	39.1% 36	

Table 4. Independent test for diabetes verses all the predictor variables.

Table 5 presents the binary logistic regression analysis with socio-demographic and clinical characteristics, and poor glycemic control. The association of poor glycemic control among non-insulin user was two times (AOR=2.44, 95% CI 1.01-5.90) greater than among those using insulin. The relative probability of poor glycemic control among non-oral medication users was low than (AOR=0.41, 95% CI 0.17-0.99) oral medication users. Compared to respondent who were not smoking, respondents who were smoking were four times (AOR=4.00, 95 % CI 1.15–13.91) more likely to have poor glycemic control. Patients who had adherent to treatment and peripheral followed recommended diet were less likely to develop poor blood glucose control compared to patient with poor adherent and did not follow the recommended diet with (AOR= 0.03, 95% CI 0.004-0.24) and (AOR=0.08, 95% CI 0.04-0.34), respectively.

Lastly, the diseases that were included in this study were found to be not associated with glycemic control. These diseases are hypertension, anaemia, retinopathy, renal disease, heart disease, stroke and HIV. Furthermore, gender, age group, education, occupation and marital status of the patient were not statistically associated with uncontrolled diabetes.

Variable (n 92)	Adjusted OR (95% CI)	P value
Gender		
Male	0.778 (0.337-1.793)	0.555
Age group		
>20	4.667 (0.297-73.384)	0.273
21-30	4.667 (0.451-48.257)	0.196
31-40	6.222 (0.623-62.159)	0.12
41-50	9.000 (0.888-91.255)	0.063
51-60	3.818 (0.375-38.830)	0.258
61-70	9.333 (0.892-97.619)	0.062
Education		
Illiterate	0.000 (0.000)	1
Primary	4.889 (0.392-60.922)	0.248
Secondary	2.532 (0.996-6.438)	0.051
Occupation		

No response	0.458 (0.039-5.414)	0.536
Employed	0.491 (0.209-1.153)	0.102
Marital status		
Single	0.500 (0.081-3.082)	0.455
Married	1.455 (0.375-5.641)	0.588
Divorced	0.375 (0.030-4.709)	0.447
Insulin		
No	2.441 (1.011-5.896)	0.047
Oral medication		
No	0.410 (0.170-0.989)	0.047
Alcohol use		
Yes	1.800 (0.685-4.729)	0.233
Smoking		
Yes	4.000 (1.151-13.906)	0.029
Adherent to antidiabetic treatment		
Yes	0.029 (0.004-0.235)	0.001
Recommended diet		
Yes	0.078 (0.009-0.657)	0.019
Regular blood sugar test		
Yes	0.113 (0.038-0.335)	0
Traditional med		
Yes	0.289 (0.058-1.447)	0.131
Reviews		
Yes	0.052 (0.018-0.151)	0
Exercise		
Yes	0.030 (0.007-0.140)	0
Hypertension		
No	0.601 (0.254-1.421)	0.246
Renal disease		
No	1.560 (0.136-17.839)	0.721
Dyslipidemia		
No	0.00 (0.000)	0.999
Anaemia		
No	0.765 (0.046-12.613)	0.851
Heart failure		
No	0.373 (0.033-4.261)	0.427
HIV		
No	0.493 (0.078-3.103)	0.451
Retinopathy		

No	0.373 (0.033-4.261)	0.427
Stroke		
No	0.000 (0.000)	0.999
Statistically significant at p value <0.05		

Table 5. Factors independently associated with poor glycemic level among patients.

Discussion

The present study was a hospital based cross sectional study conducted in the out-patient clinic at Ndola Teaching Hospital, Ndola Zambia. We have assessed the magnitude of poor glycemic control and associated factors among DM patients. Results of this study showed that the mean age of patient in was 45.9 years which was a bit low than other studies [25]. In this study 43.5% of patients with DM had poor glycemic control. This result was not comparable to those obtained in an earlier study that reported 65% and 81.9% of respondents had poor glycemic control. This significant proportion of poor glycemic control in the country shows the need to work more on self-management strategies of DM patients [26,27].

In this study we have identified that patients across all ages were properly managed for their blood glucose level. This finding was inconsistent with the study conducted in India [28]. Other studies have also found a significant relationship in age categories, alcohol use, duration of diabetes and male gender, however, our study did not bring any significant values in the mentioned three to glycaemic control. From the findings it can also be noted that smoking, sedentary type of lifestyle, not doing self monitoring of blood glucose, not following the Doctors reviews and not following the recommended diet all contributed to the causation of poor glycaemic control. Adherence to the recommended regimen did not help in reducing the burden of poor glycaemic control, this is not consistent with the findings of another study conducted at UTH which showed that non adherence of patients to their medication was the cause of poor glycaemic control [29-31].

Significant difference of poor glycemic control was observed among non-insulin users than insulin users. Consistent with this, studies from Jordan and China reported the correlation of non-insulin users and poor glycemic control. This could indicate non-insulin users had low diabetes knowledge, low-management behaviour, lower self-efficacy and lower continuity of care. Thus, we are recommending investment on getting rid of illiteracy as it has a significant impact on the reduction of diabetic morbidity and mortality [32].

Different studies reported that the presence of diseases like hypertension, anaemia, dyslipidemia, coronary heart disease, stroke, retinopathy, renal failure and HIV was associated with poor control of diabetes [33,34]. In our study, no association was found between hypertension, renal disease, HIV, stroke or anaemia and glycemic control but there was an association between Dyslipidemia and poor glycaemic as all the participants with dyslipidemia had a poor outcome of glycaemic control.

Therefore, pointers of poor glycaemic control include smoking and dyslipidemia. Practices or factors that improved glycaemic control include use of sbgm, exercise, following doctors' reviews and recommended diet and use of insulin in treating patients [35].

Limitations

- The funds made available for conducting this research were not enough and were made late, as such the sample size that was intended was not attained.
- Time allocated for doing the research was inadequate as the proposals were approved late by TDRC and the Provincial Health Offices, hence delaying the starting of collecting data and not all the people approached to take part in the study agreed.

Conclusion

From the study, the following conclusions were drawn from both our preliminary results and the results from our model in achieving our objectives; non-insulin users, dyslipidemia sedentary lifestyle, non sbgm practices, diet, not being reviewed consistently and smoking are among the main factors affecting glycemic control in patients at NTH. Therefore, an appropriate management and close monitoring is advised to limit disease complications and improve the patients' health. Moreover, attention should be paid for patient with dyslipidemia as they are associated with poor glycemic control. The prevalence of poor glycaemic control was also successfully deduced.

Recommendation

Based on the findings from this study, the following recommendations are made to reduce the burden of most disabling disease like diabetes in people.

- Future studies with a large number of patients are needed to determine the association of these disease with glycemic control.
- Counseling and improving adherence rather than changing medication or altering the dose has been suggested
- Further population-based research to be conducted

Acknowledgement

First and foremost, I wish to thank God almighty for His exceptional guidance as I was writing this Project Report. I also wish to express my sincere gratitude to my supervisor, Proff Mwanakasale for the guidance rendered from the beginning to completion of this Project Report. It was a great privilege and honor working with him.

Furthermore, I wish to acknowledge my dear parent, Mrs Chikondo for her unforgettable support both emotionally and financially. May God richly bless you.

References

1. Ahmad NS, Islahudin F and Paraidathathu T. Factors associated with good glycemic control among patients with type 2 diabetes mellitus. *J Diabetes Investig* 5 (2014): 563-569.
2. Almutairi MA, Said SM and Zainuddin H. Predictors of poor glycemic control among type two diabetic patients. *Am J Med Sci* 3 (2013): 17-21.
3. America Diabetes Association. Clinical Practice recommendations. Diabetes Care. 23 (2013): 1-133.
4. Angamo MT, Melese BH and Ayen WY. Determinants of glycemic control among insulin treated diabetic patients in Southwest Ethiopia: hospital based cross sectional study. *PloS one* 8 (2013): 61759.
5. Badedi M, Solan Y, Darraj H and Sabai A, et al. Factors associated with long-term control of type 2 diabetes mellitus. *J Diabetes Res* 2016:2109542.
6. Beaglehole R, Yach D. Globalisation and the prevention and control of non-communicable disease: the neglected chronic diseases of adults. *Lancet* 362 (2003): 903-908.
7. Bezie Y, Molina M, Hernandez N and Batista R, et al. Therapeutic compliance: a prospective analysis of various factors involved in the adherence rate in type 2 diabetes. *Diabetes Metab* 32 (2016): 611-616.
8. Bi Y, Zhu D, Cheng J and Zhu Y, et al. The status of glycemic control: a cross-sectional study of outpatients with type 2 diabetes mellitus across primary, secondary, and tertiary hospitals in the Jiangsu province of China. *Clin Ther* 32 (2014): 973-983.
9. Chuang LM, Tsai ST, Huang BY and Tai TY. The status of diabetes control in Asia-a cross-sectional survey of 24 317 patients with diabetes mellitus in 1998. *Diabet Med* 19 (2016): 978-985.
10. Curkendall SM, Thomas N, Bell KF and Juneau PL, et al. Predictors of medication adherence in patients with type 2 diabetes mellitus. *Curr Med Res Opin* 29 (2013): 1275-1286.
11. de Fronzo RA. Pharmacologic therapy for type 2 diabetes mellitus. *Ann Intern Med* 131 (2015): 281-303.
12. El Ansari N, Chadli A, El Aziz S and El Mghari, et al. Observational Study of Patients in Morocco With Uncontrolled Type 2 Diabetes Treated With Metformin and/or Sulfonylurea With or Without Insulin. *J Clin Endocrinol Metab* 5 (2015): 321-327.
13. Fseha B. Glycemic Control and it's Associated Factors in Type 2 Diabetic Patients in Suhul Hospital, Northwest Tigray, Ethiopia. *J Diabetes Metab* 8 (2017): 1-6.
14. Gunarathne A, Patel JV, Gammon B and Gill PS, et al. Ischemic stroke in South Asians: a review of the epidemiology, pathophysiology, and ethnicity-related clinical features. *Stroke* 40 (2016): 415-423.
15. Hartz A, Kent S, James P and Xu Y, et al. Factors that influence improvement for patients with poorly controlled type 2 diabetes. *Diabetes Res Clin Pract* 74 (2016): 227-232.
16. Higgins GT, Khan J and Pearce IA. Glycaemic control and control of risk factors in diabetes patients in an ophthalmology clinic: what lessons have we learned from the UKPDS and DCCT studies?. *Acta Ophthalmol Scand* 85 (2017): 772-776..
17. Hirschhorn JN. Genetic epidemiology of type 1 diabetes. *Pediatr Diabetes* 4 (2003): 87-100.
18. Kalyango JN, Owino E and Nambuya AP. Non-adherence to diabetes treatment at Mulago Hospital in Uganda: prevalence and associated factors. *Afr Health Sci* 8 (2018): 67-73.
19. Khattab M, Khader YS, Al-Khawaldeh A, and Ajlouni K, et al. Factors associated with poor glycemic control among patients with type 2 diabetes. *J Diabetes Complications* 24 (2016): 84-89.
20. Knobel H, Carmona A, Grau S and Pedro-Botet J, et al. Adherence and effectiveness of highly active antiretroviral therapy. *Arch Intern Med* 158 (2013): 1953.
21. Lee VW and Leung PY. Glycemic control and medication compliance in diabetic patients in a pharmacist-managed clinic in Hong Kong. *Am J Health Syst Pharm* 60 (2013): 2593-2596.
22. Leech J. Diabetes and Endocrinology Research: glycaemic control. *Clin Diabetes* 23 (2018): 187-190.
23. Leichter SB. Making outpatient care of diabetes more efficient: analyzing noncompliance. *Clinical diabetes* 23 (2005): 187-190.
24. Longo-Mbenza B, Vangu-Ngoma D and Nahimana D. Screen detection and the WHO Stepwise approach to the prevalence and risk factors of arterial hypertension in Kinshasa. *Eur J Cardiovasc Prev Rehabil* 15 (2008): 503-508.
25. Mbanya JC and Sobngwi E (2015) Diabetes microvascular and macrovascular disease in Africa. *J Cardiovasc Risk* 10 (2003): 97-102
26. Museng EM, Manankov A, Mudenda B and Michelo C, et al. Glycaemic control in diabetic patients in Zambia. *Pan Afr Med J* 19 (2014): 354.
27. Musenge EM, Michelo C, Mudenda B and Manankov A, et al. Glycaemic control and associated self-management behaviours in diabetic outpatients: a hospital based observation study in Lusaka, Zambia. *J Diabetes Res* 2016: 7934654.
28. Padma K, Valsangkar S and Bodhare NJ. Evaluation of knowledge and self -practices in diabetic patients and their role in disease management. *National J Commu Med* 3 (2012): 1.
29. Rwegerera GM. Adherence to anti-diabetic drugs among patients with Type 2 diabetes mellitus at Muhimbili National Hospital, Dar es Salaam, Tanzania-A cross-sectional study. *Pan Afr Med J* 17(2014).
30. Sanal TS, Nair NS and Adhikari P. Factors associated with poor control of type 2 diabetes mellitus: a systematic review and meta-analysis. *J Diabetol* 3 (2011): 1-10.
31. Tiv M, Viel JF, Mauny F and Eschwege E, et al. Medication adherence in type 2 diabetes: the ENTRED study 2007, a French Population-Based Study. *PLoS One* 7 (2012): 32412.
32. Unnikrishnan R, Anjana RM and Mohan V. Drugs affecting HbA1c levels. *Indian J Endocrinol Metab* 16 (2012): 528–531.
33. Wabe NT, Angamo MT and Hussein S. Medication adherence in diabetes mellitus and self-management practices among type-2 diabetics in Ethiopia. *N Am J Med Sci* 3 (2011): 418.
34. WHO. Preventing chronic diseases: A vital investment. Geneva: World Health Organization. 2019: 182.
35. Yan H, Prista A, Ranadive SM and Damasceno A, et al. Effect of aerobic training on glucose control and blood pressure in T2DDM East African males. *ISRN Endocrinol* 2014 (2014): 864897.

How to cite this article: Chikondo, Maggie. "Factors Associated with Poor Glycemic Control Among Patients with Diabetes Mellitus Attending out-Patient Clinic at Ndola Teaching Hospital, Ndola, Zambia." *J Clin Res* 6 (2022): 163.