

# The incidence and predictors of poor glycemic control among adults with type 2 diabetes mellitus in ambulatory clinic of mettu karl referral hospital, southwestern, Ethiopia: a prospective cross sectional study

Gudisa Bereda\* and Gemechis Bereda

SWAN diagnostic pharmaceutical importer, Addis Ababa, Ethiopia

## Abstract

**Background:** Diabetes mellitus refers to a grouping of metabolic diseases involving prolonged hyperglycemia caused by the inadequate secretion of insulin, poor insulin action, or a combination of the two. Poor glycaemic control is a major public health problem among patients with type 2 diabetes mellitus.

**Objective:** To expose the incidence and predictors of poor glycemic control among adults with type 2 diabetes mellitus in ambulatory clinic of Mettu Karl Referral Hospital.

**Methods:** An institutional based prospective cross-sectional survey was carried out from April 23/2020 to June 24/2021. Data was collected through employing structured questionnaire, and then the collected data was cleared, coded and analyzed by statistical packages for social sciences 25.0 version statistical software. Descriptive statistics such as the frequency and percentage were used. Those variables with p-value less than 0.25 in bi-variable analysis were entered into multivariable analysis. A p-value of less than 0.05 was considered significant.

**Results:** A total of 122 patients with type 2 diabetes mellitus were included in this study. The overall incidence of poor glycemic control among type 2 diabetic patients was 60.7%. Poor glycemic control was significantly associated with older age (AOR=2.98, 95%CI:1.089-2.023; P=0.034), uneducated patients (AOR=5.075, 95%CI:1.957-3.649; p=0.009), Glibenclamide+metformin drug regimen (AOR=3.95, 95%CI:1.429-3.750; p=0.018), Low adherence (AOR=2.68, 95%CI:1.764-4.928; p=0.002), cigarette smokers social habit (AOR=1.49, 95%CI:2.034-3.864; p=0.008), patients who had comorbidities (AOR=2.5, 95%CI:1.967-5.497; p=0.028), and patients who had nephropathic complication of diabetes (AOR=6.45, 95%CI:3.071-17.632; p=0.005) were the significantly associated predictors of poor glycemic control.

**Conclusion and recommendation:** Our study investigated the prevalence of poor glycemic control among type 2 diabetic patients was high. About half of the patients were on anti-diabetic medication for between one to four years and slightly less than half of oral hypoglycemic agents were most prescribed drug regimen. Health care workers should have to advice the patients about life style modification and on how they take their medication.

**Abbreviations:** ADA: American Diabetes Association; BMI: Body Mass Index; DM: Diabetes Mellitus; FPS: Fasting Plasma Sugar; HbA1c: Glycated Hemoglobin; HTN: Hypertension; MKRH: Mettu Karl Referral Hospital; SSA: Sub-Saharan Africa; T2DM: Type 2 diabetes mellitus; WHO: World Health Organization.

## Introduction

Diabetes mellitus is a serious, chronic metabolic disorders that characterized by high sugar level either when the pancreas does not produce enough insulin, or when the body cannot effectively use insulin. Type 2 diabetes mellitus (T2DM) accounts about 90% of all diagnosed cases of diabetes among adults [1]. Globally, 8.8% (415 million) of adults suffered from diabetes in 2015, and it is estimated that 652 million people (10.4%) will have diabetes by 2040. The World Health Organization (WHO) reported that high blood glucose level due to diabetes is the third highest risk factor for premature mortality after high blood pressure and tobacco use [2]. More than 77 % of morbidity and 88% of mortality due to DM occur in low and middle-income countries. In Ethiopia, the prevalence of diabetes was 3.5 % in 2011 [3]. Type 2 diabetes mellitus (T2DM) is the most common form of DM, accounting for more than 90 % of cases. Control of diabetes is more

than just taking medicine other aspects of self-management such as self-monitoring of blood glucose, dietary restrictions, regular foot care and ophthalmic examination have all been shown to markedly reduce the incidence and progression of diabetes complications [4]. The major risk factors in the development of T2DM are family history, obesity, race/ethnicity, age increment ( $\geq 40$  year), previous identified impaired fasting glucose or impaired glucose tolerance, hypertension (HTN), hyperlipidemia and history of gestational DM [5]. In Ethiopia, the prevalence of diabetes admission has increased from 1.9% in 1970 to 9.5% in 1999 of all medical admissions most importantly uncontrolled blood glucose due to non-compliance to anti-diabetic medications [6]. The American Diabetes Association (ADA) has designated HbA1c

\*Correspondence to: Gudisa Bereda, SWAN diagnostic pharmaceutical importer, Addis Ababa, Ethiopia, Tel: +251919622717, E-mail: gudisabareda95@gmail.com

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level of <7% as a goal of optimal blood glucose control and the American Association of Clinical Endocrinologist has further recommended HbA1c level of <6.5% [7]. Controlling the glycemic level is considered the main therapeutic intervention to prevent diabetes complications and further organ damage. Healthcare systems in sub-Saharan Africa (SSA) also vary widely [8]. There is poor health seeking behaviors in low resource countries because of inaccessible quality healthcare that increases the risk of DM complications. The management of DM is complex, and good glycemic control significantly reduces the risk of complications [9]. The goal of treatment for DM is to prevent mortality and complications by normalizing blood glucose level. But blood glucose level might be increased despite appropriate therapy resulting in complications, such as disturbances in fat metabolism, nerve damage, and eye disease [10].

Type 2 diabetes constitutes about 85–95% of all diabetes in high-income countries with a higher percentage in low and middle-income countries due to rapid socio-cultural changes, ageing populations, increasing urbanization, reduced physical activity and unhealthy lifestyle and behavioral patterns. It is a leading cause of blindness, end stage renal disease and stroke. These complications are two to five times more common among diabetic patients. Type 2 diabetes is associated with increased morbidity and mortality compared with the general population [11]. High glycemic control is difficult to achieve, and prior research has reported many factors as contributing to poor control among patients, including their age, gender, level of education, weight, smoking status, marital status, the duration of diabetes, the medications taken, and numerous other factors [12]. However, it has been proved difficult to confirm exactly which of these factors are most directly associated with poor glycemic control. The World Health Organization (WHO) reported that high blood glucose level due to diabetes is the third highest risk factor for premature mortality after high blood pressure and tobacco use [13]. Diabetes is attributed to 14.5% of all-cause mortality among adults, and half of these deaths occur in adults under the age of 60 years. Nonetheless, diabetic complications are a major cause of disability and reduced quality of life. The estimated total global health expenditure due to diabetes is \$673 billion in 2015, and it will reach \$802 billion in 2030 [14]. Previous findings in Ethiopia also reported that the rate of poor glycemic control was high [15], most importantly due to non-compliance to existing medications. The prevalence of poor glycemic control is paramount. A study done in Malaysia [16], 2015 showed that 72 % of patients had poor glycemic control, and two third of DM patients in Ethiopia [17] also had poor control. Previous studies assured that poor glycemic control correlated with enlarged risk of visual impairment, enlarged risk of kidney failure, and enlarged risk of cardiovascular disease [18]. This study will provide information for health-care providers and policymakers as a baseline for further study and determining the risk factors of poor glycemic control is important for its urgent management and further reduction of health-care costs related to the care needed.

## Materials and methods

### Study area, design and period

An institutional based prospective cross-sectional survey was conducted from April 23/2020 to June 24/2021, in the ambulatory clinic at Mettu Karl Referral Hospital, which located at 600 km from Addis Ababa.

### Study participants

All type 2 diabetes patients who visited the ambulatory clinic of MKRH during the data collection period & that fulfilled the inclusion

criteria was target population. Those aged 18 years or older, Patients who were on anti-diabetic medication(s) treatment for at least 6 months, Patients with at least three consecutive blood glucose, Measurements for 3 months, and patients who consented to participate were included in the study. Newly diagnosed, very sick patients, and those with physical or mental handicaps, Patients with hearing problems and previously diagnosed psychiatric were excluded.

### Sample size calculation and sampling technique

The sample size was determined by using the single population proportion formula: The sample size was determined based on “P” value which was taken from JUSH, Southwest Ethiopia,  $P=0.709$ , or 70.9%  $n = \frac{(Za/2)^2 P(1-P)}{d^2}$ ,  $n =$  sample size,  $P =$  prevalence of poor glycemic control,  $d =$  margin of sampling error tolerated,  $z =$  the standard normal value at confidence interval of 95%.  $n = (1.96)^2 (1 - 0.709) \times (0.709) / (0.05)^2 = 317$ . Since the total number of type 2 diabetes mellitus patients was less than 10,000, reduction formula (correction formula) were applied as follow  $nf = n / (1 + (n/N))$ ,  $nf = 317 / (1 + (317/170)) = 111$ . When 10% contingency is added to minimize non response rate, then final sample size was found to be 122. Purposive sampling technique was used to recruit samples for the study in each day of the data collection process until the desired sample size was obtained.

### Study variables

Dependent variable was poor glycemic control among adults with type 2 diabetes mellitus, and independent variable were Socio demographic factors (age, sex, educational status, monthly income, marital status, family size), Clinical characteristics (family histories of diabetes, the duration of disease, and self-reported comorbidities), Life style of patients' (smoking status, exercise per day and dietitians (which restricted their intakes of sugar, salt, and fat), Medications the patients were taking to manage their diabetes, and whether they self-monitored their blood glucose levels.

### Data extraction and procedure

Data was collected from the medical cards to know their blood glucose level and patients were interviewed by using a semi-structured questionnaire developed by reviewing different literature's. The data collection format contained four parts. The first part of the questionnaire involved socio-demographic data on the participating patients' age, marital status, gender, residence, education level, employment status, and income. The second part concerned their clinical characteristics, including family histories of diabetes, the duration of disease, and self-reported comorbidities. The third part gathered lifestyle data on the patients' smoking status, whether they exercised regularly (i.e., whether they were involved in at least 30 minutes of exercise per day, at least 3 days per week), and whether they followed a set dietary plan approved by dietitians (which restricted their intakes of sugar, salt, and fat). The fourth and final part had questions on the medications the patients were taking to manage their diabetes, and whether they self-monitored their blood glucose levels. The weight of each patient were measured by using  $BMI = \text{kilogram of the patients} / \text{height of patients}^2$ . Based on the calculated BMI, the patients were divided into categories reflecting the World Health Organization (WHO)'s definitions: normal range ( $BMI = 18.5 - 24.9 \text{ kg/m}^2$ ), overweight ( $BMI = 25 - 29.9 \text{ kg/m}^2$ ), and obese ( $BMI \geq 30 \text{ kg/m}^2$ ). Glycemic control was based on American Diabetic Association (ADA) recommendation into two groups as good glycemic control with fasting blood glucose of 70–130 mg/dL and poor glycemic control with fasting blood glucose of <70 mg/dL and >130 mg/dL.

## Data processing and analysis

The screened data was coded and analyzed through employing statistical packages for social sciences 25.0 version statistical software. Data are presented as the mean± standard deviation (SD) for continuous variables and proportions for categorical variables. Chi-square and bi variate logistic regression analysis was conducted to see the existence of odds association and select candidate variables with P value below 0.25 were considered to multivariable logistic regression. A 95% CI and p-value of <0.05 was considered to be statistically significant.

## Data quality assurance

All steps in data collection and recording were closely monitored by the principal investigator and daily collected data was, recorded and compiled for the next day study. Finally, the data collected will be checked for completeness and consistency on daily basis

## Ethical considerations

A formal letter was obtained from SWAN diagnostic pharmaceutical importer and official letter of co-operations was provided to mettu karl referral hospital prior to data collection. Patient consent was obtained prior to data collection and no personal identity was disclosed. The instruments and procedure were not cause any harm to the study subject. Thus, name and address of the patient was not recorded in data collection checklist.

## Operational Definitions

Poor glycemic control was operationally defined if fasting blood glucose (FBG) level was above 130 mg/dl.

## Results

### Socio-demographic characteristics of the study participants

A total of 122 type 2 diabetic patients were included in this study, of whom 67 (54.9%) were male. The largest age group was >40 years

**Table 1.** Socio-demographic characteristics of the study of T2DM patients in Mettu Karl Referral Hospital, South-western, Ethiopia, 2021

Variables	Category	Frequency	Percent
Age	≤40 years	56	45.9
	>40 years	66	54.1
Sex	Male	67	54.9
	Female	55	45.1
Residency	Urban	50	41.0
	Rural	72	59.0
Monthly income	≤ 500 ETB	79	64.8
	>500 ETB	43	35.2
Marital status	Unmarried	43	35.2
	Married	79	64.8
Educational status	Uneducated	45	36.9
	Primary	39	32.0
	Secondary	27	22.1
	Higher education	11	9.0
Social habit	Cigarette smokers	38	31.1
	Alcohol drinker	32	26.2
	Khat chewing	22	18.0
	None	30	24.6
Family history	Yes	45	36.9
	No	77	63.1
Magnitude of poor glycemic control	Yes	74	60.7
	No	48	39.3

**Table 2.** Clinical characteristics and disease related variables among T2DM patients in Mettu Karl Referral Hospital, South-western, Ethiopia, 2021

Variables	Category	Frequency	Percent
Body mass index	<18.5 kg/m <sup>2</sup>	18	14.8
	18.5–24.9 kg/m <sup>2</sup>	30	24.6
	25–29.9 kg/m <sup>2</sup>	42	34.4
	≥30 kg/m <sup>2</sup>	32	26.2
Fasting blood sugar	≤ 130gm/dl	33	27.0
	>130gm/dl	89	73.0
Blood pressure	<140/90 mmHg	78	63.9
	≥ 140/90 mmHg	44	36.1
Adherence	Low	56	45.9
	Moderate	38	31.1
	High	28	23.0
Co-morbidities	Yes	67	54.9
	No	55	45.1
Complication	Retinopathy	16	13.1
	Cardiac complications	17	13.9
	Nephropathy	32	26.2
	Neuropathy	12	9.8
	None	45	36.9
Type of co-morbidities	Hypertension	55	45.1
	DKA	5	4.1
	Renal disease	21	17.2
	Peripheral neuropathy	29	23.8
	Other	12	9.8
Type of treatment	Non-pharmacological	33	27.0
	Pharmacological	89	73.0

which accounted for 66 (54.1%). A majority 72(59.0%) of patients were live in rural area and 79(64.8%) were earn monthly income ≤500 ETB. Majority 79(64.8%) of patients were married and 43 (35.2%) of patients were uneducated. Preponderance 38(31.1%) of patients had social habit which mostly accounted for cigarette smokers and 30(24.6%) had now social habit. A majority 77(63.1%) of patients had no family history. The overall incidence of poor glycemic control among type 2 diabetic patients was 74(60.7%) (Table 1).

### Clinical characteristics and disease related characteristics

A majority 42(34.4%) of the respondents were overweight. Great majority 89(73.0%) of participants had >130gm/dl fasting blood sugar and 78(63.9%) had <140/90 mmHg blood pressure. Regarding adherence 56(45.9%),38(31.1%),28 (23.0%) was low, moderate and high respectively. Above half 67(54.9%) of type 2 diabetic patients were had at least one comorbidities and 32(26.2%) had nephropathy diabetic complication. Hypertension 55(45.1%) was the most present comorbidities followed by renal disease 29(23.8%). Majority 89(73.0%) of study participants were pursue pharma cological only rather they use nonpharmacological treatment (Table 2).

### Medication related and lifestyle related characteristics

About half 62(50.8%) of the patients were on anti-diabetic medication for between 1-4 years and slightly above one half 68(55.8%) of oral hypoglycemic agents were most prescribed drug type. Metformin 41(33.6%) was the mostly recommended drugs followed by Metformin and NPH insulin 34(27.9%). Above half 77(63.1%) of patients had ≤2 number drugs they take and less than half 50(41.0%) of patients had at least one concomitant medication. Enalapril 21(42%) most concomitant medication administered followed by Enalapril+ASA 16(32%). Above half 66(54.1%) of patients had inadequate health diet

**Table 3.** Medication related and life style related characteristics among T2DM patient s in Mettu Karl Referral Hospital, South-western, Ethiopia, 2021

Variables	Category	Frequency	Percent
Duration of treatment	1-4 years	62	50.8
	5-10 years	43	35.2
	> 10 years	17	13.9
Drug regimen	Oral hypoglycemic agents	87	71.3
	Oral hypoglycemic agents+ Insulin	35	28.7
Type of DM drugs	Metformin	41	33.6
	Glibenclamide and metformin	19	15.6
	Glibenclamide	17	13.9
	Metformin and NPH insulin	34	27.9
	Metformin+Glibenclamide+ insulin	11	9.0
Numbers of drugs taken	≤2 drugs	77	63.1
	> 2 drugs	45	36.9
Concomitant medication	Yes	50	41.0
	No	72	59.0
Type of concomitant medication	Enalapril	21	42.0
	Enalapril + ASA	16	32.0
	Enalapril + ASA + atenolol	9	18.0
	Enalapril+ASA+hydrochlorothiazide	4	8.0
Health diet	Adequate	56	45.9
	Inadequate	66	54.1
Physical exercise	Yes	43	35.2
	No	79	64.8
Foot care	Yes	27	22.1
	No	95	77.9
Self monitoring blood glucose	Yes	35	28.7
	No	87	71.3

and 79(64.8%) hadn't do physical exercise. A majority 95 (77.9%) of participants had not care their foot and 87(71.3%) had not have self-monitoring blood glucose (Table 3).

### Logistic regression analysis of the association between independent variables and poor glycemic control among T2DM

The relative odds of poor glycemic control was 2.98-times (AOR=2.98,95%CI=1.089 -2.023, P=0.034) higher among patients in the age ≤40 years compared to the ages of greater than 40 years. Regarding educational status uneducated patients were 1.75 more likely had poor glycemic control(AOR=1.75,95%CI=1.957-3.649,P=0.009) than primary, secondary and higher educational status. Patients who take Glibenclamide and metformin drug regimen were 3.95 more likely had poor glycemic control (AOR=3.95,95%CI=1.967-9.645, P=0.018) than those who taken others regimen. Low adherence were 2.68 more likely had poor glycemic control (AOR=2.68,95% CI=1.967-9.645,P=0.002) than moderate and high adherence. Patients who whose cigarette smokers social habit were 1.49 more likely had poor glycemic control (AOR=1.49,95%CI=1.967-9.645,P=0.008) than those who had others social habit. Patents who had comorbidities were

2.5 more likely have poor glycemic control (AOR=2.5,95% CI=1.967-5.497, P=0.028) than who hadn't comorbidities. Participant who had nephropathic complication of diabetes were 6.45 more likely had poor glycemic control (AOR=6.45,95%CI=1.967-5.497, P=0.005) than those who had others complication (Table 4).

### Discussion

Patients with diabetes have a 2-to-4-fold increase in the risk of both cardiovascular and cerebrovascular disease, resulting in an increased mortality rate among patients with diabetes compared to the general population [19]. The main goal of diabetes management is to ensure optimal glycemic control. Poorly controlled T2DM results in increased rates of micro and macrovascular diabetic complications which in turn lead to increased healthcare costs [20].

The present study revealed that the overall prevalence of poor glycemic control among type 2 diabetic patients was 60.7% were lower than study conducted in Military Hospital in Hodeidah 73.2%,Ethiopia 64.72%,Bangladesh 82%,Saudi Arabia 74.9%,Kuwait 78.8% [21-25]. The differences was due to delay in the begging and intensification of unnecessarily and poor adherence to anti-diabetic treatments and also

**Table 4.** Logistic regression analysis of the association between independent variables and poor glycemic control among T2DM patients in Mettu Karl Referral Hospital South-western, Ethiopia, 2021

Variables	Category	n(%)	AOR (95% C.I)	P-value
Age	≤40 years	56(45.9)	2.98(1.089-2.023)	0.034
	>40 years	66(54.1)	1	
Sex	Male	67(54.9)	1.96(1.043-1.848)	0.078
	Female	55(45.1)	1	
Educational status	Uneducated	45(36.9)	1.75(1.957-3.649)	0.009
	Primary	39(32.0)	1.01(1.968-1.967)	0.869
	Secondary	27(22.1)	0.364(0.067-1.028)	0.184
	Higher education	11(9.0)	1	
Type of DM drugs	Metformin	41(33.6)	1.873(1.921-2.340)	0.09
	Glibenclamide and metformin	19(15.6)	1.043(1.429-3.750)	0.018
	Glibenclamide	17(13.9)	0.740(0.694-1.947)	0.873
	Metformin and NP H insulin	34(27.9)	1.75(1.967-2.645)	0.095
	Metformin+ Insulin + Glibenclamide	11(9.0)	1	
Adherence	Low	56(45.9)	2.68(1.764-4.928)	0.002
	Moderate	38(31.1)	1.146(1.437-2.746)	0.645
	High	28(23.0)	1	
Social habit	Cigarette smokers	38(31.1)	1.978(2.034-3.864)	0.008
	Alcohol drinker	32(26.2)	1.34(1.564-2.853)	0.07
	Khat chewing	22(18.0)	5.68(2.968-12.476)	0.061
	None	30(24.6)	1	
Comorbidity	Yes	67(54.9)	2.5(1.967-5.497)	0.028
	No	55(45.1)	1	
Duration of treatment	1-4 years	62(50.8)	0.478(0.021-1.017)	0.476
	5-10 years	43(35.2)	2.15(1.967-4.231)	0.005
	> 10 years	17(13.9)	1	
Residency	Urban	50(41.0)	1.254(1.694-2.078)	0.045
	Rural	72(59.0)	1	
Type of complication	Retinopathy	16(13.1)	0.285(0.047-1.074)	0.178
	Neuropathy	17(13.9)	1.476(1.967-2.863)	0.710
	Nephropathy	32(26.2)	6.45(3.071-17.632)	0.095
	Cardiac complications	12(9.8)	1.435(1.849-2.147)	0.453
	None	45(36.9)	1	

include less life style modification which perhaps no health diet, and low physical exercise. Our study was in line with the study conducted in Middle East and the Horn of Africa 61.1%, Shanan Gibe hospital 59.2% [26,27]. This similarity was due to in sub-saharan Africa patients may not acquire their medication because they earn low monthly income and rural area residents patients had not got more education about disease burden and medication due to they far from social media and health center. The current study were higher than Saudi Arabia 50%, china 50.3%, Zimbabwe 58.2% [28-30]. This is because in our study diabetic patients were educated in the hospital how they use their medication somewhat.

In our study the incidence of poor glycemic control were observed in older ages > 40 years perhaps consistent with the study done in Bangladesh [24] which revealed that the prevalence of DM was more among old age group. This is because older adults were at high risk for the development of diabetic mellitus due to the combined effects of increasing insulin resistance and impaired pancreatic islet function with aging. And older agents are most vulnerable population, so diabetes increases the risk of falls, urinary incontinence, dementia, depression, vision and hearing loss. Besides, more likely to have functional limitations and report disability.

In our study uneducated type 2 diabetic patients had more poor glycemic control than primary, secondary, higher educational level were consistent with the study employed in Ethiopia [31] which displayed the significant difference of poor glycemic control was observed among illiterates than college/university graduates. This is because uneducated patients had no more hint on how and when to take the medication, how to monitor self-blood glucose sugar, how to take care for themselves and the no use balanced program of exercise and rest which help him/her keep blood sugar stable. Due lack comprehend they didn't use carbohydrate as snack when they feel weak.

The current study observed that males were at higher risk to developing poor glycemic control than females were inline with the study done in a Suburban Tertiary Hospital in North-Western Nigeria [32] which observed that males were at higher risk of having poor glycaemic control compared to females. The reason whose males store more fat in their bellies, plasma levels of low density lipoprotein (bad cholesterol) and triglycerides were high in males, and males had smoking cigarette, being overweight, avoiding physical activity.

The present showed 63.1% patients had at least one complication. Here Nephropathy were the most commonly occurred diabetic complication and Neuropathy were the least occurred diabetic complication were higher than the study conducted in Tertiary Hospital in Northeast Ethiopia [33] which revealed that 59.7% of diabetic patients had at least one diabetic complication. The current survey were lower than the study conducted in Jimma, Ethiopia, where 83.0%. Because diabetic nephropathy was a common complication of type I and type II diabetes. Overtime poorly control diabetes can cause damage to blood vessels clusters in the kidney that filter waste from the body.

The relative odds of poor glycemic control was 2.98-times (AOR=2.98,95%CI=1.089 -2.023, P=0.034) higher among patients in the age  $\leq$ 40 years compared to the ages of greater than 40 years. Regarding educational status uneducated patients were 1.75 more likely had poor glycemic control (AOR=1.75,95%CI=1.957-3.649, P=0.009) than primary, secondary and higher educational status. Patients who take Glibenclamide and metformin drug regimen were 3.95 more likely had poor glycemic control (AOR=3.95,95%CI=1.967-9.645,P=0.018) than those who taken others regimen. Low adherence were 2.68 more likely had poor glycemic control (AOR=2.68,95%

CI=1.967-9.645, P=0.002) than moderate and high adherence. Patients who whose cigarette smokers social habit were 1.49 more likely had poor glycemic control (AOR=1.49,95%CI=1.967-9.645,P=0.008) than those who had others social habit. Patents who had comorbidities were 2.5 more likely have poor glycemic control (AOR=2.5,95% CI=1.967-5.497, P=0.028) than who hadn't comorbidities. Participant who had nephropathic complication of diabetes were 6.45 more likely had poor glycemic control (AOR=6.45,95%CI=1.967-5.497, P=0.005) than those who had others complication.

## Conclusion and Recommendation

Our study investigated the prevalence of poor glycemic control among type 2 diabetic patients was high. About half of the patients were on anti-diabetic medication for between one to four years and slightly above one half of oral hypoglycemic agents were the most prescribed drug regimen. Above half of diabetic patients were had at least one comorbidities and had nephropathy diabetic complication. Hypertension was the most present comorbidities followed by renal disease. Age less than forty years, uneducated patients, glibenclamide and metformin drug regimen, low adherence, cigarette smokers, patients who had comorbidities, and patients who had nephropathic complication of diabetes were significantly factors associated with glycaemic control. Health care workers should have to advice the patients about life style modification and on how they take their medication.

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## References

1. Marathe PH, Gao HX, Close KL (2017) American diabetes association standards of medical care in diabetes. *J Diabetes* 40: 1-142.
2. Ogurtsova K, da Rocha Fernandes JD, Huang Y (2017) IDF Diabetes Atlas: Global estimates for the prevalence of diabetes for 2015 and 2040. *Diabetes Res Clin Pract* 128: 40-50. [Crossref]
3. IDF (2013) Diabetes and impaired glucose tolerance. 6th ed. Brussels: Diabetes Atlas.
4. Whiting DR, Guariguata L, Weil C, Shaw J (2011) IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes Res Clin Pract* 94: 311-321.
5. Sacks FM, Svetkey LP, Vollmer WM, Appel LJ, Bray GA (2001) Effects on blood pressure of reduced dietary sodium and the dietary approaches to stop hypertension (DASH) diet. *N Engl J Med* 344: 3-10
6. Desse TA, Eshetie TC, Gudina EK (2015) Predictors and treatment outcome of Hyperglycemic emergencies at Jimma University Specialized Hospital, southwest. *BMC Res Notes* 8: 1-8.
7. Adham M, Froelicher ES, Batiha A, Ajlouni K (2010) Glycaemic control and its associated factor in type 2 diabetic patients in Amman, Jordan. *East Mediterr Health J* 16: 732-739. [Crossref]
8. Mohammad H, Amir N, Maryam H, Girish T, Surulivelrajan M (2018) Factors that correlate with poor glycemic control in type 2 diabetes mellitus patients with complications. *Osong Public Health Res Perspect* 9: 167-174.
9. Alberti H, Boudriga N, Nabli M (2007) Primary care management of diabetes in a low/middle income country: a multi-method, qualitative study of barriers and facilitators to care. *BMC Fam Pract* 8: 63.
10. Fauci AS (2008) Principles of Internal Medicine. Ed: 17th McGraw-Hill, New York, NY, USA.
11. Tadele E, Abrahaley M, Gebretsadik H, Getu K, Dagim A, Yerra R (2016) Factors associated with poor glycemic control in type 2 diabetic patients investigated at Ayder Referral Hospital, Mekelle, Ethiopia. *Ijppr Human* 6: 160-171.
12. Cheneke W, Suleman S, Yemane T, Abebe G (2016) Assessment of glycemic control using glycated hemoglobin among diabetic patients in Jimma University specialized hospital I, Ethiopia. *BMC Res Notes* 9: 96.

13. World Health Organization, Global Health Risks (2009) Mortality and Burden of Disease Attributable to Selected Major Risks, World Health Organization, Geneva.
14. Cho NH (2015) IDF Diabetes Atlas pp.1-142, Ed: 7<sup>th</sup> International Diabetes Federation.
15. Temesgen F, Ermiyas A, Wongelawit K, Aderaw A, Angesom G (2018) Factors associated with glycemic control among diabetic adult outpatients in Northeast Ethiopia. *BMC Res Notes* 11: 316.
16. Firouzi S, Barakatun-Nisak MY, Azmi KN (2015) Nutritional status, glycemic control and its associated risk factors among a sample of type 2 diabetic individuals, a pilot study. *J Res Med Sci* 20: 40-6.
17. Abebe SM, Berhane Y, Worku A, Alemu S, Mesfin N (2015) Level of sustained glycemic control and associated factors among patients with diabetes mellitus in Ethiopia: a hospital-based cross-sectional study. *Diabet Metab Syndr Obes* 8: 65-71.
18. Colagiuri S, Lee CM, Wong TY, Balkau B, Shaw JE (2011) Glycemic thresholds for diabetes-specific retinopathy: implications for diagnostic criteria for diabetes. *Diabet Care* 34: 145-150.
19. Team DMG (2014) Management of Type 2 Diabetes Mellitus. In: Management U editor
20. Koro CE, Bowlin SJ, Bourgeois N, Fedder DO (2004) Glycaemic control from 1988 to 2000 among U.S. adults diagnosed with type 2 diabetes: a preliminary report. *Diabetes Care* 27: 17-2019.
21. Sultan AM Saghir (2019) Factors associated with poor glycemic control among type-2 diabetes mellitus patients in Yemen. *Tropical Journal of Pharmaceutical Research* 18: 1539-1546.
22. Agalu A Abejew, Zeleke A Belay, Woldie M Kerie (2015) Diabetic Complications among Adult Diabetic Patients of a Tertiary Hospital in Northeast Ethiopia. *Advances in Public Health* 7.
23. Afroz A, Ali L, Karim MN, Alramadan MJ, Alam K, et al. (2019) Glycaemic Control for People with Type 2 Diabetes Mellitus in Bangladesh -An urgent need for optimization of management plan. *Sci Rep* 9: 10248.
24. Alshenghiti AM, Alsadran FF, Alzahrani RA, Assiri I (2016) Sleep quality among type 2 Saudi diabetics. *Med J Cairo Uni* 167-171.
25. Al-Ibrahim AA (2012) Factors Associated with Compliance to Diabetes Self Care Behaviors and Glycemic Control Among Kuwaiti People with Type 2 Diabetes. *University of Maryland* 5: 1314-1328.
26. Sulaiman AM, Saghir SA, Al-Hassan FM, Yusoff NM, Zaki AH (2013) Molecular characterization of glucose-6-phosphate dehydrogenase deficiency in a university community in Malaysia. *Trop J Pharm Res* 12: 363-367.
27. Miteku YD, Alemu DT (2017) Glycemic control and associated factors among type 2 diabetic patients at shanan gibe hospital, southwest ethiopia. *BMC Res Notes* 10: 597.
28. Almutairi MA, Said SM, Zainuddin H (2013) Predictors of Poor Glycemic Control among Type two Diabetic Patients. *Am J Med Sci* 3: 17-21.
29. Li J, Chattopadhyay K, Xu M, Chen Y, Hu F, et al. (2018) Glycaemic control in type 2 diabetes patients and its predictors: a retrospective database study at a tertiary care diabetes centre in Ningbo, China. *BMJ Open* 8: e019697. [[Crossref](#)]
30. Chirombe M, Ngara B, Chibvongodze R, Charuka V (2018) Glucose Control in Diabetic Patients Attending Parirenyatwa Group of Hospitals in Zimbabwe. *The Open Clinical Biochemistry Journal* 19: 9-12.
31. Tekalegn Y, Addissie A, Kebede T, Ayele W (2018) Magnitude of glycemic control and its associated factors among patients with type 2 diabetes at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia. *PLoS ONE* 13: e0193442. [[Crossref](#)]
32. Yakubu A (2020) Determinants of Poor Glycaemic Control among Type 2 Diabetic Patients at a Suburban Tertiary Hospital in North-Western Nigeria. *International Journal of Science and Healthcare Research* 5: 4.
33. Alebachew M Woldu (2014) Factors Associated with Poor Glycemic Control among Patients with Type 2 Diabetes Mellitus in Ambo Hospital, Ambo, Ethiopia. *Endocrinol Metab Syndr* 3: 4.