Research Article

iMedPub Journals
www.imedpub.com

Endocrinology and Metabolism: Open Access

2020
Vol.4 No.2:1

DOI: 10.36648/endocrinology-metabolism.4.2.1

Determinants of Poor Glycemic Control among Diabetes Mellitus Patients in Public Hospitals of the Central Zone, Tigray, North Ethiopia, 2018: Unmatched Case-Control Study

Teklewoini Mariye*, Degena Bahrey, Hagos Tasew, Girmay Teklay, Gebrewahd Bezabh Gebremichael, Tewolde Teklu, Guesh Mebrahtom and Woldu Aberhe

College of Health Science and Comprehensive Specialized Hospital, Aksum University, Tigray, Ethiopia

***Corresponding author:** Dr. Teklewoini Mariye, Department of Adult Health Nursing, School of Nursing, College of Health Science and Comprehensive Specialized Hospital, Aksum University, Tigray, Ethiopia, Tel: 0966744324; E-mail: teklewoini1@gamil.com

Received date: June 08, 2020; **Accepted date:** June 22, 2020; **Published date:** June 29, 2020

Citation: Mariye T, Bahrey D, Tasew H, Teklay G, Gebremichael GB, et al. (2020) Determinants of Poor Glycemic Control among Diabetes Mellitus Patients in Public Hospitals of the Central Zone, Tigray, North Ethiopia, 2018: Unmatched Case-Control Study. Endocrinol Metab Vol.4 No.2.

Abstract

Background: Poor glycemic control is a major determinant for complications of diabetes mellitus. In order to prevent the complications, identifying the determinants of poor glycemic control are imperative. However, only few studies were conducted related to this topic, particularly in Tigray. Hence, this study was aimed at identifying the determinants of poor glycemic control in the Centeral Zone of Tigray, North Ethiopia.

Methods: A hospital based case-contrl study was conducted from from August 1 to September 30, 2018. A total of 87 cases and 173 controls selected by systematic random sampling technique were included in the study. Data were entered into Epi data version 3.1.1 and exported to SPSS version 23 for further analysis. Bivariable logistic regression analysis followed by multivariable logistic regression analysis (AOR, 95% CI and p value<0.05) was conducted to determine the association between the independent variables and glycemic control.

Results: The mean age (±Standard deviation) for the controls and the cases were 56 (SD: ± 10.97) and 44.6 (SD: ± 16.6) with standard error of 0.83 and 1.78 respectively. This study identified that not being a member of Ethiopian diabetes association [AOR=2.68, 95% CI [1.23,5.81], and non-adherence to medication [AOR=2.13, 95% CI [1.07,4.23], diet [AOR=4.05,95% CI [1.88,8.73], exercise [AOR=2.53, 95% CI [1.29,4.93] and self-monitoring of blood glucose level [AOR=4.57, 95% CI [2.02, 10.34] were the factors which significantly associated with poor glycemic control.

Conclusion: The results of this study indicated that not being member of Ethiopian diabetes association and non-adherence to diabetic medication, diet, exercise and self-monitoring of blood glucose level were found to be the determinants of poor glycemic control among diabetic patients.

Keywords: Determinants; Diabetes Mellitus; Glycemic control; Ethiopia

Background

Diabetes Mellitus (DM) is defined as a group of metabolic disorders characterized by hyperglycemia and results from defects in insulin secretion, insulin action, or both. There are several types of diabetes mellitus and all of them can lead to acute and chronic complications. In addition, they can increase the overall risk of premature mortality [1].

Diabetes Mellitus has been “one of the largest global health emergencies in the 21st century”. It is likely to be the biggest epidemic in human history [2]. It was estimated that in the 2017, there were 451 million (18-99 years of age) people with diabetes mellitus worldwide. With the current trajectory, the worldwide prevalence of diabetes mellitus is expected to rise to 693 million (9.9%) by 2045, and most of them will be people living in low and middle-income countries. Worldwide, approximately five million deaths (20-99 years of age) were attributable to diabetes mellitus. As a result, diabetes mellitus was responsible for 9.9% of the global all-cause mortality among people within this age range. The global healthcare expenditure on adults with diabetes mellitus was estimated to be US Dollar 850 billion in 2017 [3].

To minimize the burden of diabetes mellitus, strictly maintaining a person’s blood glucose level in the normal or close to the normal range is crucial. Glycemic control is defined as Fasting Blood Sugar (FBS) level of 80–130 mg/dL (4.4-7.2 mmol/L) or hemoglobin A1c (HbA1c)<7% in adults who are not pregnant. This range is the center of diabetes management in order to prevent or delay the onset of complications. Glycemic control is significantly associated with decreased rates of development and progression of microvascular and macrovascular complications and mortality [4].

A strong relationship was found between poor glycemic control (HbA1c ≥ 7%) and the risk of complications and mortality

in people with diabetes mellitus. Poor glycemic control constitutes a major public health problem and is a major risk factor for the development and progression of diabetes-related complications [5]. The World Health Organization reported that high blood glucose level due to diabetes mellitus is the third highest risk factor for premature mortality which is next to high blood pressure and tobacco use [6].

Poor glycemic control can cause a number of complications and socio-economic consequences that might negatively impact the affected individuals and their families, society, and healthcare system. It is a risk factor for development of both macrovascular complications such as coronary heart disease, peripheral vascular disease and stroke; and micro-vascular complications such as retinopathy, nephropathy and diabetic foot disease. All these complications contribute to the high morbidity and mortality associated with diabetes mellitus [7,8]. Moreover, poor glycemic control is the cause for high mortality beyond those deaths directly caused by diabetes mellitus [9].

However, though poor glycemic control has fatal and non-fatal consequences, achieving proper glycemic control still remains challenging. The epidemiological data suggest that in the majority of patients, the glycemic control is poor [10-12]. Poor glycemic control among patients with diabetes mellitus is common in many countries including Indonesia (83%) [13], Bangladesh (81.2%) [14], Saudi Arabia (74.9%) [11], Libya (78.2%) [15], Dares Salaam (69.7%), Tanzania (71.9%) [16], Eastern Sudan [17].

Studies indicate that glycemic control is achieved by only 30.1% of patients with diabetes mellitus [18]. Nearly 80% of type 2 diabetes mellitus patients in Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia had poor glycemic control [19]. More than two third (70.9%) of type 2 diabetes mellitus patients in Jimma university hospital also had poor glycemic control [20]. Similarly, a study was done in Gondar University hospital which also indicated that 70.8% of the patients had poor blood glycemic control [21].

Nevertheless, though there are cross-sectional studies in the different regions of Ethiopia, there is inconsistency between the variables that associated with poor glycemic control. In addition, cross-sectional study did not show a direct relationship between the dependent and independent variable. As a result, case-control study design appears to be a good option to identify the predictors.

There is a programme called Healthy People 2020 which is aimed at 10% reduction in the proportion of DM patients with poor glycemic control. To achieve this global action plan, cost-effective and evidence-based interventions targeting the determinants of poor glycemic control are essential. Despite the increasing prevalence of DM in Ethiopia, only few studies were conducted regarding the determinants of poor glycemic control. Therefore, this study was aimed at identifying the determinants of poor glycemic control among DM patients in public hospitals of the Central Zone,Tigray, Ethiopia.

Materials and Methods

Study area and period

The study was conducted among patients with DM attending in public Hospitals of the Central Zone of Tigray regional state of Ethiopia. There are three general hospitals and one Comprehensive Specialized Hospital in the zone. The data were collected from August 1 to September 30, 2018.

Study design

Hospital-based case-control study study design was conducted among diabetes mellitus patients.

Population

The source population for cases were all patients with DM whose HbA1C value was ≥ 7%, whereas the source population for controls were all patients with DM who had Hemoglobin A1C value of<7%. The study population was all the sampled diabetes mellitus patients.

Eligiblity criteria

All diabetic patients with HbA1C ≥ 7% were included in the study as cases and all diabetic patients with HbA1C<7% were included in the study as controls. However, pregnant diabetic mothers were excluded from the study.

Sample size determination

EPI Info software version 7.1.1 was used to calculate the sample size with the following parameters: Significance=95%; Power=80%; Odds ratio=2.47. The Odds ratio was taken from a study conducted in Jimma University Teaching Hospital, Southwest Ethiopia in 2014 [20]. Case to control ratio=1:2; Proportion of controls with exposure was 20.2% and the proportion of cases with exposure=38.5%. Assuming a non-response rate of 10%, the sample size for cases was 87 while the sample size for controls was 173. The overall sample size was 260.

Sampling technique and procedure

A systematic random sampling technique was used to select the study subjects. K for cases and controls was calculated by total cases and controls (N) divided by the total sample size (n) of the cases and controls in each hospital, respectively. Using the K value, the patients were selected in every K interval for cases and controls, and the first study subject was selected by lottery method.

Variables

The dependent variable of this study was poor glycemic control and the independent variables were socio-demographic characteristics (sex, age, educational status, residence, marital status, occupation, ethnicity and religion), health profile (body mass index, duration of DM, and other comorbidities), and

behavioral factors (adherence todiabetic diet, exercise, diabetic medication and blood glucose measurement.

Data collection tool and technique

Patient record review was used to identify cases and controls using checklists. After cases and controls were segregated, checklist and semi-structured pre-tested questionnaire were used for data collection. The questionnaire had three parts: social demographic data, health profile of the study subjects and behavioral factors. The Summary of Diabetic Care Activity (SDCA) was used to measure the behavioral factors such as adherence to diabetes-related exercise and self-monitoring of blood glucose level. Moreover, Modified Morse Scale (MMS) was used to measure other behavioral factors such as adherence to medication and diet. The reliability and validity of SDCA and MMS questionnaires were tested among similar study subjects in a study conducted in Ethiopia [22]. It was also used in previous studies in evaluating adherence to diabetes medication and diabetes diet among DM patients [23,24]. Other DM related variables that might influence values of glycemic control were taken from medical history record and these were duration with DM, the presence of complications, type of medication currently taken and type of DM.

Weight was measured in light clothing and without shoes in kilograms (kg) using calibrated United Nations Children's Fund (UNICEF) Seca Digital Weighing Scale and was checked every six patients by another calibrated UNICEF Seca Digital Weighing Scale [25]. Height was also measured using Stadiometer in centimeter (cm) in an erect position in which the back of the head, shoulder blades, buttocks, and heels make contact with the backboard at a precision [26].

The study participants were given an orientation on the protocol and specific details regarding the study and their participation in it. The data were collected by four nurses who are B.Sc holders and two supervisors who are M.Sc holders.

Data quality assurance

The questionnaire was initially prepared in English and then translated into the local language (Tigrigna) by Tigrigna and English language experts. To ensure consistency the questionnaire was again translated back into English by a different language expert. The questionnaire was pretested in 5% of the sample size in a different health institution which was not included in the main study. The collected data were reviewed and checked daily for completeness and for consistency by the supervisor and principal investigators at the spot during the data collection.

Data processing and analysis

Data were entered into Epi data version 3.1 and analyzed using SPSS version 23. Analysis using bivariable logistic regression was done to see the association between the dependent and independent variables. This was followed by multivariable logistic regression analysis using those variables with P value less or equal to 0.2 in the bivariable analysis. To check fitness of the model, the Hosmer-Lemen show test was used. Multi-collinearity was assessed by variance inflation factor. Cross tabulations were used to summarize descriptive statistics, and all assumptions of binary logistic regression were checked. Odds ratio with 95% CI was used for measuring the strength of association. p value<0.05 was considered as statistically significant.

Operational definitions

Good glycemic control: Aglycemic control was considered to be good when a patient had HbA1c ≤ 7% for adult diabetic patients, and less than 8% for patients with comorbid and/or vascular complications and/or age greater than 60 and/or history of sever hypoglycemia [27].

Poor glycemic control: a glycemic control was considered to be poor when a patient had HbA1c higher than 7% for adult diabetic patients, and higher than 8% for comorbid and/or vascular complications and/or age greater than 60 and/or history of sever hypoglycemia [27].

Adherence to exercise: A patient was considered to have adhered to DM-related exercises when the patient scored at least 50% of the total of SDCA [27,28].

Adherence with dietary regimen: A patient was considered to have adhered to DM-addressing dietary regimen when the patient scored at least 50% of the total MMS dietary related questions [24,29].

Adherence to medication: A patient was considered to have adhered to his/her anti-diabetic medication when the patient scored at least 80% of the total of Mo risky medication scale related questions [29].

Adherence with blood glucose measurement: Adherence was recorded when patients scored at least 50% of the summary of diabetes care blood sugar testing questions [26,28].

Results

Socio-demographic profile of the respondents

A total of 87 DM patients with poor glycemic control (cases) and 173 DM patients with good glycemic control (controls) were included in this study with a response rate of 100%. From the total respondents, seventy-seven (44.5%) controls and fouty-four (50.6%) cases were female participants. The mean age (± Standard deviation) for the cases and controls were 44.6 (SD: ± 16.6) and 56 (SD:±10.97) and respectively. Thirty-seven (21.4%) controls and thrity-three (37.9%) cases were living in rural areas. Concerning marital status, eleven (6.4%) controls and twenty-three (26.4%) cases were single. Fourty-seven (27.2%) controls and nineteen (21.8%) cases couldn't read and write. The majority of controls (97.7%) and all the cases (100%) were Tigru. Most of the controls (82.7%) and more than half of the cases (58.7%) were Orthodox Christians. More than a qaurter of the controls (26.6%) and cases (27.6%) were government employees (**Table 1**).

Table 1: Socio-demographic profile of study populationon a study conducted on determinats of poor glycemic control among

patients with diabetes mellitus in public hospitals of CenteralZone of Tigray, Ethiopia, 2018.

Variables	Category	Good glycemic control	Poor glycemic control	Total	p value
Sex	Male	96(55.5%)	43(49.4%)	139(53.5%)	0.36
	Female	77(44.5%)	44(50.6%)	121(46.5%)	
Age	<60 years	119(68.8%)	65(74.7%)	184(70.8%)	0.32
	60-70 years	37(21.4%)	18(20.7%)	55(21.2%)	
	>70 years	17(9.8%)	4(4.6%)	21(8.1%)	
Residence	Urban	138(78.6%)	54(62.1%)	190(73.1%)	0.05
	Rural	37(21.4%)	33(37.9%)	70(26.9%)	
Marital status	Married	136(78.6%)	52(59.8%)	188(72.3%)	0
	Single	11(6.4%)	23(26.4%)	34(13.1%)	
	Widowed	13(7.5%)	3(3.4%)	16(6.2%)	
	Divorced	13(7.5%)	9(10.3%)	22(8.5%)	
Educational level	Cannot read and write	47(27.2%)	19(21.8%)	66(25.4%)	0.053
	Can read and write	23(13.3%)	6(6.9%)	29(11.2%)	
	Primary y school	33(19.1%)	28(32.2%)	61(23.5%)	
	Secondary school	28(16.2%)	19(21.8%)	61(23.5%)	
	College and above	42(24.3%)	15(17.2%)	57(21.9%)	
Occupation	House wife	45(26%)	19(21.8%)	64(24.6%)	
	Governmental employee	46(26.6%)	24(27.6%)	70(26.9%)	
	Private employee	50(28.9%)	23(26.4%)	73(28.1%)	0.83
	Daily worker	4(2.3%)	3(3.4%)	7(2.7%)	
	Farmer	28(16.2%)	18(20.7%)	46(17.7%)	
Religion	Orthodox	143(82.7%)	81(93.1%)	224(86.2%)	0.02
	Muslim	30(17.3%)	6(6.9%)	36(13.8%)	

Health profile of the respondents

The mean duration of cases and controls since diagnosis was 4.71 (SD: ± 3.21) and 6.20 (SD: ± 4.12) respectively. Of the total respondents, 70 (40.5%) controls and 18 (20.7%) cases had medically confirmed DM related comorbidity. Half (50.0%) of controls and 10 (55.6%) of cases were presented with hypertension.

Majority of the controls (73.4%) and cases (83.9%) did not follow education about DM. Only few of the controls (19.1%) and cases (26.4%) were not members of the diabetes association. More than a qaurter of the controls (27.7%) and close to one third of the cases (36.8%) had glucometer in their home. The majority of the controls (93.1%) and cases (78.2%) were using oral hypoglycemic medication(s) for treatment. Only few of the controls (10.4%) and cases (12.6%) were obese. Majority of participants (81.5%) were diagnosed with type 2 DM (**Table 2**).

Table 2: Health profile of study populationof participants of a study conducted on determinats of poor glycemic control among patients with diabetes mellitus in public hospitals of Centeral Zone of Tigray, Ethiopia, 2018.

Variable	Category	Good glycemic	Poor glycemic	Total	p-value
Duration with DM	<=one year	15(8.7%)	12(13.8%)	27(10.4%)	
	2-5 year	71(41%)	43(49.4%)	114(43.8%)	
	>= six years	87(50.3%)	32(36.8%)	119(45.8%)	0.09
Comorbidity	Yes	70(40.5%)	18(20.7%)	88(33.8%)	
	No	103(59.5%)	69(79.3%)	172(66.2%)	0.02
Type of comorbidity	Hypertension	35(50.0%)	10(55.6%)	45(51.1%)	0.9
	Dislipedemia	24(34.3%)	5(27.8%)	29(33.0%)	
	Cardiovascular diseases	8(11.4%)	3(16.7%)	11(12.5%)	
	Others	3(4.3%)	0(0.0%)	3(3.4%)	
Current medication you take	Insulin	10(5.8%)	19(21.8%)	29(11.2%)	
	Oral hypoglycemic	161(93.1%)	68(78.2%)	229(88.1%)	0
	Both	2(1.2%)	0(0.0%)	2(0.8%)	
Do you follow education about DM	Yes	46(26.6%)	14(16.1%)	60(23.1%)	
	No	127(73.4%)	73(83.9%)	200(76.9%)	0.063
Are you Member of DM association	Yes	140(80.9%)	64(73.6%)	204(78.5%)	0.2
	No	33(19.1%)	23(26.4%)	56(21.5%)	
Have glucometer	Yes	48(27.7%)	32(36.8%)	80(30.8%)	
	No	125(72.3%)	55(63.2%)	180(69.2%)	0.15

BMI status	Normal	92(53.2%)	35(40.2 %)	127(48.8 %)	0.1 9
	Over weight	53(30.6%)	37(42.5 %)	90(34.6%)	
	Under weight	10(5.8%)	4(4.6%)	14(5.4%)	
	Obese	18(10.4%)	11(12.6 %)	29(11.2%)	
Type of DM	Type one	0(0%)	48(55.2 %)	48(18.5%)	
	Type two	173(100%)	39(44.8 %)	212(81.5 %)	0

Behavioral factors of the respondents

More than half (53.2%) of the controls and slightly less than half (46.0%) of the cases adhered to their medication. More than half (57.8%) of the controls and more than three-fourth (79.3%) of the cases did not adhere to the DM diet. Similarly, most of the controls (76.9%) and cases (59.8%) adhered to exercise. Only few (13.3%) of the controls and most (56.3%) of the cases did not adhere to self-monitoring of blood glucose level (**Table 3**).

Table 3: Behavior factors on determinant of poor glycemic controls among patients with Diabetes mellitus at public Hospitals, Central Zone, Tigray, Ethiopia,2018.

Variables	Category	Good glycemic control	Poor glycemic control	Total	p value
Adherence to Medication	Adhered	92(53.2%)	40(46.0%)	121(46.5%)	
	Not adhered	81(46.8%)	47(54%)	139(53.5%)	1
Adherence to Diet	Adhered	73(42.2%)	18(20.7%)	91(35%)	0.00 1
	Not adhered	100(57.8%)	69(79.3%)	169(65%)	0.01
Adherence to Exercise	Adhered	133(76.9%)	52(59.8%)	185(71.2%)	0.00 6
	Not adhered	40(23.1%)	35(40.2%)	75(28.8%)	
Adherence to SMBG	Adhered	150(86.7%)	52(59.8%)	202(77.7%)	0
	Not adhered	23(13.3%)	35(40.2%)	58(22.3%)	

Factors associated with poor Glycemic controls

In bivariate logistic analysis, residence, educational status, marital status, using glucometer at home, attending diabetes education, being member of diabetes association, duration since diagnosed with DM, comorbidity, body mass index, adherence to medication, self-monitoring of blood glucose level, exercise, and diet were found statistically associated with poor glycemic control at p value ≤ 0.2.

However, in the multivariable logistic regression analysis only five variables were found to be independent predictors of poor glycemic control among DM patients at p value<0.05%.

Not being members of Ethiopian diabetes association was significantly associated with poor glycemic control. The odds of having poor glycemic control in diabetes patients who were not members of diabetes association were 2.68 times [95% CI (1.23, 5.81)] higher than patients who were members of the diabetes association.

Not being adherent to the recommended exercise was significantly associated with poor glycemic control. The odds of having poor glycemic control in diabetic patients who were not adherant to exercise were 2.53 times [95% CI (1.29, 4.93)] higher than those who were adherent to physical exercise. The odds of having poor glycemic control in diabetic patients who were not adhering to their diet were 4.05 times [95% CI (1.88, 8.73)] times higher than those who were not adhering to their diet.

The odds of having poor glycemic control in diabetic patients who were not adhering to their medication were 2.13 times [95% CI (1.07, 4.23)] higher than those who were adhering to their medication. The odds of having poor glycemic control in diabetic patients who did not adhere to SMBG were 4.57 times [95% CI (2.02, 10.34)] higher than those who were adherent to SMBG (**Table 4**).

Table 4: Logistic regression analysis on Determinants of poor glycemic among patients with diabetes mellitus at public hospitals of Central Zone Tigray, Ethiopia, 2018.

Variables	Category	Good glycemic	Poor glycemic	COR [95%CI]	AOR [95%CI]
Member of DM association	Yes	140(80.9 %)	23(26.4 %)	1	1
	No	33(19.1 %)	23(26.4 %)	1.52[0.83,2. 80]	2.68[1.23, 5.81]
Adherence to Medication	Adherent	92(53.2 %)	40(46.0 %)		
	Not adherent	81(46.8 %)	47(54%)	0.96[0.57,1. 62]	2.13[1.07,4.2 3]
Adherence to Diet	Adherent	73(42.2 %)	18(20.7 %)	1	1
	Not adherent	100(57.8 %)	69(79.3 %)	2.79[1.53,5, 09]	4.05[1.88,8.7 3]
Adherence to Exercise	Adherent	133(76.9 %)	52(59.8 %)	1	1
	Not adherent	40(23.1 %)	35(40.2 %)	2.24[1.28,3. 90]	2.53[1.29,4.9 3]
Adherence to SMBG	Adherent	150(86.7 %)	52(59.8 %)	1	1

	Not adherent	23(13.3 %)	35(40.2 %)	4.39[2.37,8.10]	4.57[2.02,10.34]

Discussion

A case-control study was conducted to assess the determinants of poor glycemic control in diabetic patients at public hospitals of the Central Zone of the Tigray Regional State of Ethiopia in the 2018.

Not being member of the Ethiopian diabetic association was significantly associated with the poor glycemic control. This might be because the Ethiopian Diabetes Association enables diabetic patients to have knowledge and skill on DM and its overall management [30]. Different researches have shown that knowledge on DM is associated with better glycemic control [31]. Even though, having knowledge could contribute for a better self-management of diabetes mellitus, there are researches which found no association between knowledge on DM and glycemic control [32] which may be attributed to the difference in the research design used.

Non-adherence to exercise showed significant association with poor glycemic control. The result of this study is consistent with a cross-sectional study conducted in Uganda in 2017 [33]. This association could be due to the effect of exercise on reduction of hemoglobin A1c either by increasing insulin secretion from the beta cells or decreasing insulin resistance from the cell of our body [34]. However, this finding is not similar with a cross-sectional study conducted in in 2013 in Tripoli [15] and in Zambia [35]. The difference could be due to difference in exercise adherence measurement, sample size, design, and study year.

Non-adherence to DM diet showed statistical association with poor glycemic control. The finding of this study was consistent with a cross-sectional study conducted at Jimma University Hospital in 2013 [36]. Adhering to dietary recommendations can improve glycemic control and may reduce glycosylated hemoglobin [37] because DM-dietary foods have low glycemic index [38,39].

Non-adherence to DM medications was found to have association with poor glycemic control. Cross sectional studies conducted in other parts of Ethiopia also indicated similar results that poor adherence to medication was associated with poor glycemic control [34,40]. The reason could be that non-adherence to anti-diabetes medication may expose the patient to uncontrolled elevation of blood glucose level by speeding up glucose production from the liver, by decreasing insulin secretion from the beta cells or by decreasing glucose uptake by the skeletal muscles [41].

Diabetic patients who did not adhere to SMBG recommendations were found to have more poor glycemic control. In a cohort study which included 24,312 adult patients, frequent self-monitoring of blood glucose level was found to have association with good glycemic control [42]. The potential reason for this result could be that frequent self-monitoring of blood glucose level may enabled them to better control glycemic level as this could guide on how to respond and adjust their treatment regimen in line with blood glucose level. These findings are supported by the clinical recommendations suggested by the American Diabetes Association [42].

Conclusion

The results of this study showed that not being member of the Ethiopian diabetic association, and non-adherence to diabetes medication, diet, exercise and self-monitoring of blood glucose level were found to be the determinants of poor glycemic control among diabetic patients. Hence, health care providers should improve patients' practice to the domains of diabetes management by strengthening information, and by promoting education and communication programs. It is recommended that another research should be carried out to investigate the determinants of poor glycemic control among diabetic patients in a broader social context and in a larger sample size.

References

1. Brunner LS, Brunner (2010) Suddarth's textbook of medical-surgical nursing. Lippincott Williams and Wilkins. 1.
2. Zimmet PZ (2017) Diabetes and its drivers: the largest epidemic in human history? Clinical Diabetes and Endocrinology. 3: 1.
3. Cho NH, Shaw JE, Karuranga S, Huang Y, Da Rocha Fernandes JD, et al. (2018) IDF Diabetes Atlas: global estimates of diabetes prevalence for 2017 and projections for 2045. Diabetes Research and Clinical Practice. 138: 271-281.
4. American Diabetic Association (2018) Glycemic targets: standards of medical care in diabetes-2018. Diabetes Care. 41: S55-S64.
5. Diabetes A (2016) Standards of medical care in diabetes-2016 Abridged for Primary Care Providers. Am Diabetes Assoc. 34: 3-21.
6. Organization WH. (2009) Global tuberculosis control: epidemiology, strategy, financing: WHO report 2009. World Health Organization.
7. Iorio A, Ylli D, Polimanti R, Picconi F, Maggio P, et al. (2018) Effect of the GSTM1 gene deletion on glycemic variability, sympatho-vagal balance and arterial stiffness in patients with metabolic syndrome, but without diabetes. Diabetes Research and Clinical Practice. 138: 158-168.
8. Association AD (2018) Cardiovascular disease and risk management: standards of medical care in diabetes-2018. Diabetes Care. 41: S86-S104.
9. World Health Organization (2016) World health statistics 2016: monitoring health for the SDGs sustainable development goals. World Health Organization.
10. Khan DA, Saeed M, Khan FA (2009) Is glycemic control in patients with type-2 diabetes in Rawalpindi improving. J Ayub Med Coll Abbottabad. 21: 62-65.
11. Alzaheb RA, Altemani AH (2018) The prevalence and determinants of poor glycemic control among adults with type 2 diabetes mellitus in Saudi Arabia. Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy. 11: 15.
12. Camara A, Baldé NM, Sobngwi-Tambekou J, Kengne AP, Diallo MM, et al. (2015) Poor glycemic control in type 2 diabetes in the South of the Sahara: the issue of limited access to an HbA1c test. Diabetes Research and Clinical Practice. 108: 187-192.

13. Pamungkas RA, Mayasari A, Nusdin N (2017) Factors associated with poor glycemic control among type 2 diabetes mellitus in indonesia. Belitung Nursing Journal. 3: 272-280.

14. Selim S, Pathan F, Saifuddin M, Latif ZA, Karim N (2016) The challenge of proper glycaemic control among patients with type 2 diabetes in Bangladesh. Sri Lanka Journal of Diabetes Endocrinology and Metabolism. 6: 16.

15. Ashur ST, Shah SA, Bosseri S, Fah TS, Shamsuddin K (2016) Glycaemic control status among type 2 diabetic patients and the role of their diabetes coping behaviours: a clinic-based study in Tripoli, Libya. Libyan Journal of Medicine. 11: 31086.

16. Kamuhabwa AR, Charles E (2014) Predictors of poor glycemic control in type 2 diabetic patients attending public hospitals in Dar es Salaam. Drug, Healthcare and Patient Safety. 6: 155.

17. Omar SM, Musa IR, Osman OE, Adam I (2018) Assessment of glycemic control in type 2 diabetes in the Eastern Sudan. BMC Research Notes. 11: 373.

18. Aschner P, Galiardino JJ, Ilkova HM, Lavalle-Gonzalez FJ, Ramachandran A, et al. (2018) Poor Glycemic Control in People with T1D and T2D-Results from the International Diabetes Management Practices Study (IDMPS). Am Diabetes Assoc. 67: 1656

19. Tekalegn Y, Addissie A, Kebede T, Ayele W, et al. (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.

20. Kassahun T, Eshetie T, Gesesew H (2016) Factors associated with glycemic control among adult patients with type 2 diabetes mellitus: a cross-sectional survey in Ethiopia. BMC Research Notes. 9: 78.

21. Fiseha T, Alemayehu E, Kassahun W, Adamu A, Gebreweld A (2018) Factors associated with glycemic control among diabetic adult out-patients in Northeast Ethiopia. BMC Research Notes. 11: 316.

22. Berhe KK, Demissie A, Kahsay AB, Gebru HB (2012) Diabetes self care practices and associated factors among type 2 diabetic patients in Tikur Anbessa specialized hospital, Addis Ababa, Ethiopia-A Cross Sectional Study. IJPSR. 3: 4219.

23. Wabe N, Angamo M, Hussein S (2011) Medication adherence in diabetes mellitus and self management practices among type-2 diabetics in Ethiopia. North American Journal of Medical Sciences. 3: 418-423.

24. Worku A, Abebe SM, Wassie MM (2015) Dietary practice and associated factors among type 2 diabetic patients: a cross sectional hospital based study, Addis Ababa, Ethiopia. SpringerPlus. 4: 15.

25. Control, C.f.D. and Prevention (2009) National Health and Nutrition Examination Survey (NHANES) anthropometry procedures manual. USA: CDC, 2012.

26. Beckles GL, Engelgau MM, Narayan KV, Herman WH, Aubert RE, et al. (1998) Population-based assessment of the level of care among adults with diabetes in the US. Diabetes Care. 21: 1432-1438.

27. Cheng AYY, C.D.A.C.P.G.E. Committee (2013) Canadian Diabetes Association 2013 clinical practice guidelines for the prevention and management of diabetes in Canada. Canadian Journal of Diabetes. 37: S1.

28. Al-Kaabi J, Al-Maskari F, Afandi B, Parkar H, Nagelkerke N (2009) Physical activity and reported barriers to activity among type 2 diabetic patients in the United Arab Emirates. RDS. 6: 271-278.

29. Morisky DE, DiMatteo MR (2011) Improving the measurement of self-reported medication nonadherence: response to authors. Journal of Clinical Epidemiology 64: 255-257.

30. Ethiopian Diabetes Association. (2018) Available from: http://www.diabetesethiopia.org.et/ accessed on Nov 17.

31. Chrvala CA, Sherr D, Lipman RD (2016) Diabetes self-management education for adults with type 2 diabetes mellitus: a systematic review of the effect on glycemic control. Patient Education and Counseling. 99: 926-943.

32. Islam SMS, Niessen LW, Seissler J, Ferrari U, Biswas T, et al. (2015) Diabetes knowledge and glycemic control among patients with type 2 diabetes in Bangladesh. SpringerPlus. 4: 284.

33. Mary OJ (2017) Assessment of antidiabetic medicines use and glycemic control among type 2 diabetes mellitus patients at lacor hospital, Uganda. University of Nairobi.

34. Boulé NG, Haddad E, Kenny GP, Wells GA, Sigal RJ (2001) Effects of exercise on glycemic control and body mass in type 2 diabetes mellitus: a meta-analysis of controlled clinical trials. JAMA. 286: 1218-1227.

35. Musenge EM, Michelo C, Mudenda B, Manankov A (2016) Glycaemic control and associated self-management behaviours in diabetic outpatients: a hospital based observation study in Lusaka, Zambia. Journal of Diabetes Research. 2016: 1-9

36. Angamo MT, Melese BH, Ayen WY (2013) Determinants of glycemic control among insulin treated diabetic patients in Southwest Ethiopia: hospital based cross sectional study. PloS One. 8: e61759.

37. Shamsi N, Shehab Z, Al-Nahash Z, Al-Muhanadi S, Al-Nasir F (2013) Factors influencing dietary practice among type 2 diabetics. Bahrain Medical Bulletin. 35: 130-135.

38. American Diabetes Association (2008) Nutrition recommendations and interventions for diabetes: a position statement of the American Diabetes Association. Diabetes Care. 31: S61-S78.

39. Association AD (2008) Nutrition recommendations and interventions for diabetes: a position statement of the American Diabetes Association. Diabetes Care. 31: S61-S78.

40. 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. Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy. 8: 65.

41. Dunning T (2010) Assessment and management of patients with diabetes mellitus. Smeltzer and Bare's Textbook of Medical-Surgical Nursing. 1219-1270.

42. Karter AJ, Ackerson LM, Darbinian JA, D'Agostino RB, Ferrara A, et al. (2001) Self-monitoring of blood glucose levels and glycemic control: the Northern California Kaiser Permanente Diabetes registry. The American Journal of Medicine. 111: 1-9.