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Level of glycemic control and its associated factors among type II diabetic patients in debre tabor general hospital, northwest Ethiopia

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ABSTRACT

Introduction: Poor glycemic control is the major risk factor for the development of acute and chronic diabetes complications. There are limited studies on the level of glycemic control and its associated factors among diabetic patients. So, this study aimed to assess the level of glycemic control and its associated factors among type II DM patients in Debre Tabor General Hospital.

Methods: An institution based cross sectional study was conducted from November 1−30, 2017. Totally, 413 diabetic patients selected by systematic random sampling. The three months average fasting blood glucose was used to determine glycemic control. Regressions were fitted to identify associated factors. A p-value <0.05 was used to declare statistical significance.

Result: A total of 398 study participants were participated in the study with a response rate of 96.4%. Among 398 type II DM patients, 284 (71.4%) had poor glycemic control. Patient's educational status (able to read and write; AOR = 3.0, 95%CI (1.5, 5.7), (primary education; AOR = 4.5, 95%CI (1.8, 10.9), and (secondary education; AOR = 5.7, 95% CI (2.9, 11.2)))), family history of DM (AOR = 2.3, 95%CI (1.4, 3.9)), duration of DM since diagnosis (AOR = 0.3, 95% CI (0.1, 0.9)), and dietary adherence (AOR = 2.4, 95% CI (1.4, 4.1)) were associated factors to had good glycemic control.

Conclusion: Poor glycemic control was high. Educational status, family history of DM, duration of DM, and dietary adherence were the associated factors of glycemic control. Appropriate attention shall be given for glycemic control especially for patients with a longer duration. Health promotion related to medical recommendations is a cross-cutting intervention for diabetic patients and should be provided for all type II diabetic patients.

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1. Introduction

Diabetics Mellitus is a raised level of glucose in the blood due to either the body cannot produce enough amount of insulin hormone or use insulin effectively [1]. The global prevalence and impact of diabetes mellitus have increased dramatically, particularly in sub-Saharan Africa [2,3]. This is one of the major public health problem in developing countries due to the most rapid epidemiological transitions [4,5].

In 2012 diabetes mellitus caused 1.5 million deaths worldwide among this 43% befall before the age of 70 years [1]. Globally it is estimated that 425 million people live with diabetes aged 20−79 years [6], 90% of whom accounts for type 2 diabetes mellitus [7], and it will raise up to 642 million by 2040 [8]. The prevalence of diabetes in Africa has raised from 4 million in 1980 to 25 million in 2014, which increased by 129% (3.1% in 1980 to 7.1% in 2014). From this, Ethiopia accounts for 3.8% [1], and 9% was gestational diabetes mellitus [9]. In sub-Saharan Africa, 90% of people living with type 2 diabetes mellitus typically associated with increased age and obesity [9,10].

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Diabetics Mellitus has a wide range of medical complications including retinopathy, neuropathy, and micro-albuminuria. Also, it increases the risk of numerous infectious diseases like tuberculosis, pneumonia, and sepsis. The burden is very high particularly in Sub-Saharan Africa [9]. Glycemic control remains the major focus of type 2 diabetes mellitus management [11]. Poor glycemic control among type 2 diabetes mellitus patients constitutes a major public health problem and a risk factor for the development of acute and chronic diabetes complications [12−14]. Studies evidenced that good glycemic control reduces the risk of diabetic related complications and death [15,16].

Despite, of the importance of good glycemic control, evidences showed that there is poor glycemic control in Ethiopia [17−20]. Different studies evidenced that being unable to read and write, farmer, having poor medication adherence [20], duration with diabetics [12,21,22], and duration of diabetics treatment [21] were the significant associated factors for poor glycemic control among type 2 diabetic patients. This study was aimed to assess the level of glycemic control and its associated factors among type 2 diabetic patients who had a follow up at Debre Tabor General Hospital, Northwest Ethiopia.

2. Methods and participants

2.1. Study design, period, and area

An institution based cross sectional study design employed from November 01−30/2017 at Debre Tabor General Hospital. Debre Tabor General Hospital found in Debre Tabor Town, South Gondar Zone of Amhara Regional State. The Town is 667 km far from the capital city of Ethiopia in the Northwest direction and 102 km far from Bahir Dar Town.

2.2. Sample size determination and sampling procedure

The sample size was calculated by using single population proportion formula considering the prevalence of poor glycemic control (57.5%) among type 2 diabetic patients from the previous study done in Ethiopia [23], 95% of confidence level, 5% of marginal error, and none response rate of 10%. Finally, 413 study participants were a part of this study. A systematic random sampling technique was employed to select the study participants. A total of 850 type 2 diabetic patients had follow up at Debre Tabor General Hospital. Then, we calculate the Kth interval that was 2. So, we interview the study participants every 2 type 2 diabetic patients. All type 2 diabetic patients aged ≥18 years who had at least one-year outpatient follow up at Debre Tabor General Hospital were included in the study. Whereas, newly diagnosed type 2 diabetic patients, critically ill, and unable to speak and hear at the time of data collection were not part of this study.

2.3. Data collection

The data were collected by two trained BSc Nurses by face to face interviews using a pre-tested and structured questionnaire. Patient chart review done to determine the three-month average Fast Blood Sugar (FBS) and diabetics related complications. The dietary adherence status was assessed by Perceived Dietary Adherence Questionnaire (PDAQ) [25], and diabetic related knowledge assessed by Diabetes Knowledge Test (DKT) questionnaire [26].

2.4. Data processing and analysis

The collected data entered into EpiData version 3.1, then double entry was made. The entered data were exported to Statistical Package for Social Science (SPSS) version 20 software for further analysis. Descriptive statistics was employed for the socio-demographic characteristics of the respondents. Bivariate and multivariable logistic regression was done to identify independent factors of glycemic control. A p-value of less than 0.25 was used to select candidate variables for multivariable logistic regression. Hosmer and Lemeshow's goodness-of-fit test was used to check the data were appropriate for the multiple logistic regression model. Crude Odds Ratio (COR) and Adjusted Odds Ratio (AOR) with 95% CI were employed to determine the strength of associated factor of type 2 diabetic patient glycemic control. Finally, a p - value < 0.05 used to declare statistical significance.

2.5. Operational definitions

Good glycemic control was defined as an average of three consecutive fasting blood glucose measurement between 80 130 mg/dl. Poor glycemic control was defined as patients who had average blood glucose measurements on three consecutive visits >130 or <70 mg/dl [27].

The Perceived Dietary Adherence Questionnaire (PDAQ) was 9-item seven-point Likert scale questionnaires to assess the dietary adherence status of the patients within the last seven days. PDAQ has a total of 63 scores for 9-item questions, and for each item, a higher score reflects higher dietary adherence except items 4 and 9, which was reversely coded. To declare good dietary adherence having total sum scores of ≥31.5 points. Diabetes Knowledge Test (DKT) questionnaire has 23-item multiple choice questions. Item 01−14 designed for all adult diabetic patients. The DKT score was determined by dividing the number of correct answers to the total number of questions (14 for those receiving oral hypoglycemic agents). Patients with the scores of ≥75%, 74−60%, and ≤59% were used to declare good, medium, and poor diabetic related knowledge respectively. Respondents having good and medium diabetic related knowledge were merged into good diabetic related knowledge [29].

2.6. Ethical consideration

The study was conducted after getting an ethical clearance letter from Debre Tabor University Ethical Review Committee. The data were collected after obtaining permission from Debre Tabor General Hospital Medical Director and Chief Executive Director. Informed consent was obtained from each study participant. The name of the study participants was not registered for the assurance of confidentiality and social desirability bias. Individuals were informed that they could withdraw at any time of the interview.

3. Results

3.1. Socio-demographic and clinical characteristics of the respondents

A total of 398 study participants were participated in the study making the response rate of 96.4%. The majority of the study participants were males 211 (53%). The mean (±SD) age of patients with type 2 diabetes was 52.63 (±12.34) years. Most of the respondents were orthodox religion follower (357 (89.7%))and 283 (71.1%) of them had a family history of diabetes mellitus (Table 1).

Out of 398 study participants, 71.4% had poor glycemic control. The mean (±SD) of fasting blood glucose was 175.52 (±69.34) mg/dl with interquartile range of (213- 124 mg/dl). The mean duration of DM since diagnosis of diabetes mellitus and starting of treatment was 5.32 and 5.18 years respectively. Among the total of respondents who had glucometer at home, 34.9% had good glycemic

Table 1

Socio-demographic Characteristics of Patients with Type 2 Diabetes Mellitus Attending their Follow up at the Diabetic Clinic of Debre Tabor General Hospital, Ethiopia, 2017 (n = 398).

Variables		Frequency	Percent (%)
Sex	Male	211	53.0
	Female	187	47.0
Age	18−34 years	10	2.5
	35−50 years	189	47.5
	51−64 years	128	32.2
	≥65 years	71	17.8
Marital Status	Single	44	11.1
	Married	272	68.3
	Divorced	71	17.8
	Separated	11	2.8
Religion	Orthodox	357	89.7
	Protestant	7	1.8
	Muslim	34	8.5
Residence	Urban	234	58.8
	Rural	164	41.2
Educational Status	Unable to read and write	177	44.5
	Able to read and write	75	18.8
	Primary education	30	7.5
	Secondary education	45	11.3
	Higher education and above	71	17.8
Occupational Status	Government employee	89	22.4
	Merchant	74	18.6
	Farmer	142	35.7
	NGO	34	8.5
	Housewife	59	14.8
Family history of DM	No	283	71.1
	Yes	115	28.9
Distance from the Hospital	≤30 min	144	36.2
	>30 min	254	63.8
Smoking	Yes	16	4.0
	No	382	96.0

Level of glycemic Control and Clinical Characteristics of the Respondents.

control as compared to not having glucometer at home (26.9%) (Table 2).

In bivariate logistic regression; age of the patient, marital status, residence, educational status, family history of DM, duration of DM since diagnosis, ever had diabetic education, and dietary adherence were significantly associated factors with good glycemic control among type II DM patients.

In multivariable logistic regression; patient's educational status, family history of DM, duration of DM since diagnosis, and dietary adherence were statistically associated with good glycemic control

among type II diabetic patients.

Diabetic patients who could read and write were 3 times more likely to have good glycemic control as compared with those who couldn't read and write (AOR = 3.0, 95%CI (1.5, 5.7)). Type II Diabetic patients who learned up to primary educational level were 4 times more likely to have good glycemic control as compared with those who couldn't read and write (AOR = 4.5, 95%CI (1.8, 10.9)). Diabetic patients who achieved college and above educational status were 5.7 times more likely to have good glycemic control as compared with those who couldn't read and write (AOR = 5.7, 95%

Table 2

Sociodemographic and clinical characteristics of patients with type 2 diabetes mellitus patients attending their follow up at the diabetic clinic of Debre Tabor General Hospital, Ethiopia, Ethiopia, 2017 (n = 398).

Variables		Glycemic Control Level		Total N
		Poor N (%)	Good N (%)	
Sex	Male	146 (69.2)	65 (30.8)	211
	Female	138 (73.8)	49 (26.2)	187
Resident	Urban	157 (67.1)	77 (32.9)	234
	Rural	127 (77.4)	37 (22.6)	164
Duration of DM Treatment	1−5 years	161 (65.2)	86 (34.8)	247
	6−10 years	90 (78.9)	24 (21.1)	114
	>10 years	33 (89.2)	4 (10.8)	37
Number of medications taken per day	One	69 (59.5)	47 (40.5)	116
	Two and above	215 (76.2)	67 (23.8)	282
Having glucometer at home	No	228 (73.1)	84 (26.9)	312
	Yes	56 (65.1)	30 (34.9)	86
Chronic illness	No	178 (73.9)	63 (26.1)	241
	Yes	106 (67.5)	51 (32.5)	157
Dietary adherence status	Poor Adherence	99 (78.6)	27 (21.4)	126
	Good Adherence	185 (68.0)	87 (32.0)	272

Factors associated with glycemic control.

CI (2.9, 11.2)).

Type II diabetic patients who had a family history of diabetes mellitus was 2.1 times more likely to have good glycemic control as compared with those who didn't have a family history of diabetes mellitus (AOR = 2.3, 95%CI (1.4, 3.9)). Type II diabetic patients with greater than 10 years duration since diagnosis were 70% less likely to have good glycemic control as compared with those with less than 5 years duration of diabetes mellitus since diagnosis (AOR = 0.3, 95% CI (0.1, 0.9)).

Diabetic patients who had good dietary adherence were 2.4 times more likely to have good glycemic control as compared with those who had poor dietary adherence (AOR = 2.4, 95% CI (1.4, 4.1)) (Table 3).

4. Discussion

Chronic non-communicable diseases are becoming the problems of low- and middle-income countries like Ethiopia. Diabetes is the commonest of all chronic non-communicable diseases. Glycemic control is vital diabetes care and management for diabetic patients. Poor glycemic control is a major health problem that greatly contributes to the development of diabetes-related complications.

The result of this study showed that the level of glycemic control among type II diabetic patients is 71.4% which is consistent with the finding at Dessie Referral Hospital (70.8%), Jimma University Teaching Hospital (70.9%), Turkey (67.5), Myanmar (72.1%), and Saudi Arabia (74.9%) [12,20,30–32]. On the other hand, it is below than the study conducted at Tikur Anbessa Hospital (80%), South Africa (83.8%), Kenya (81.6%), India (91.8%), and Palestine (80.5%) [33–37]. On the other hand, it is higher than the study done at Zambia (61.3%), Limmu Genet Hospital (63.8%), Suhul Hospital (63.5%), Nigeria (55%), Ayider Specialized hospital (48.7%) and Shenen Gibe Hospital (59.2%) [21,38–42]. The possible justification for the discrepancy may be due to the difference in the quality of care given for the patients at each hospital that the study done and the method used to assess the glycemic level.

The result of our study revealed that the educational status of type II diabetic patients had a significant association with glycemic control. Diabetic patients who can read and write, learned primary school, and achieve college and above were 3, 4 and 5.7 times more likely to have good glycemic control respectively as compared with those who couldn't read and write. The finding of this study is consistent with the study conducted at Dessie Referral Hospital, Jimma University Teaching Hospital, and Shenen Gibie Hospital [20,21,30,39]. The reason may be due to educational status's effect on patient's adherence to medical recommendations.

Here, the family history of diabetes mellitus patients had association with glycemic control of diabetes mellitus. Type II diabetic patients who had a family history of diabetes mellitus were 2.1 times more likely to have good glycemic control. The finding is similar to the study conducted in Saudi Arabia [32]. The probable reason may be diabetes patients with a family history of diabetes mellitus may have better information related to medical recommendations of diabetic patients.

Our study showed that the duration of diabetes since diagnosis had a significant association with glycemic control of type II diabetes patients. Type II diabetic patients with greater than 10 years duration were 70% less likely to have good glycemic control as compared with those <5 years duration of diabetes mellitus since diagnosis. The result is in line with studies done at Tikur Anbessa Hospital, Dessie Referral Hospital, South Africa, Limmu Genet Hospital, Malaysia, Ayider Referral Hospital, Palestine, Jordan, and Saudi Arabia [30,32,33,37,39,42–44]. The possible justification may be the relationship between duration of illness and the ability to secret insulin among type II diabetes mellitus patients. Also, age by itself may be the contributing factor.

The result of this study revealed that adherence to dietary recommendation had significant associated with glycemic control among type II diabetes patients. Diabetic patients who have good dietary adherence were 2.4 times more likely to have good glycemic control as compared with those who have poor dietary adherence. This finding is consistent with the study conducted at Suluh Hospital, Ethiopia and India [18,36].

5. Conclusion and recommendations

The level of glycemic control among type II diabetes patients

Table 3
Factors associated with glycemic control among type 2 diabetes mellitus patients attending their follow up at the diabetic clinic of Debre Tabor General Hospital, Ethiopia, 2017. (n = 398).

Variables		Poor glycemic control	Good glycemic control	COR (95% CI)	AOR (95% CI)	P-value
Age of the patient	18–34 years	3	7	7.4 (1.7,31.9)		
	35–50 years	128	61	1.5 (0.8,2.8)		
	51–64 years	99	29	0.9 (0.5, 1.8)		
	Above 65 years	54	17	1		
Marital status	Single	22	22	1		
	Married	197	73	0.4 (0.2, 0.7)		
	Divorced	56	15	0.3 (0.1, 0.6)		
	Separated	7	4	0.6 (0.1, 2.2)		
Residence	Urban	157	77	1		
	Rural	127	37	0.6 (0.4–0.9)		
Educational status	Unable to read and write	149	27	1	1	
	Able to read and write	50	25	2.6 (1.4,5.0)	3.0 (1.5, 5.7)	0.001
	Primary education	17	13	4.1 (1.8,9.3)	4.5 (1.8, 10.9)	0.001
	Secondary education	34	11	1.7 (0.8, 3.8)	2.2 (1.0, 5.0)	0.066
	College and above	34	37	5.8 (3.1, 10.7)	5.7 (2.9, 11.2)	0.001
Family history of DM	No	215	68	1	1	
	Yes	69	46	2.1 (1.3, 3.3)	2.3 (1.4, 3.9)	0.001
Duration of DM since diagnosis	Less than 5 years	155	86	1	1	
	5–10 years	89	24	0.5 (0.3, 0.5)	0.6 (0.3, 1.0)	0.062
	Greater than 10 years	40	4	0.2 (0.1,0.5)	0.3 (0.1, 0.9)	0.032
Ever had diabetic education	No	44	240	1		
	Yes	10	104	2 (0.9, 3.9)		
Dietary adherence	Poor	99	27	1	1	
	Good	185	87	1.7 (1.1, 2.8)	2.4 (1.4,4.1)	0.002

was poor. The educational status, having a family history of DM, duration of DM since diagnosis, and dietary adherence to dietary recommendations were independent predictors of glycemic control among type II DM patients.

During diabetes patient follow up, clinicians should give appropriate attention to glycemic control since it is the main goal of diabetes management. Special attention shall be given for DM patients with a longer duration. Health professionals shall put their effort into evidence generation, health promotion, and awareness creation about diabetes mellitus and its control.

Data availability

We have the data of this research article and can provide it as per the request.

Funding statement

CRediT authorship contribution statement

Alemayehu Digssie Gebermariam: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Validation, Writing - original draft, Writing - review & editing. **Sofonyas Abebaw Tiruneh:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Validation, Writing - original draft, Writing - review & editing. **Asnakew Achaw Ayele:** Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Validation, Writing - original draft, Writing - review & editing. **Henok Getachew Tegegn:** Conceptualization, Methodology, Software, Supervision, Visualization, Writing - review & editing. **Belete Achamyelew Ayele:** Conceptualization, Methodology, Software, Supervision, Visualization, Writing - review & editing. **MelakuTadege Engidaw:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Supervision, Visualization, Writing - review & editing.

Declaration of competing interest

We declare that we have no competing interests.

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