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Diabetic Complications and Associated Factors among Diabetic Patients in Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia

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Abstract

Background: Diabetes mellitus is a rapidly increasing chronic disease associated with complications resulting in long-term damage and failure of various organ systems. In Ethiopia, there is a dearth of evidence on the prevalence of Diabetic complications.

Objective: To assess the prevalence of diabetic complications and associated factors among diabetic patients on follow-up at the diabetic center of Tikur Anbessa Specialized Hospital.

Methods: This was an institutional-based cross-sectional study design conducted from April 14-May 24, 2020. Data were collected by face-to-face interview and medical record review using a pre-tested data collection tool. The collected data was entered into SPSS version 25 and descriptive statistics were performed. The multiple logistic regression model was used to identify the predictors for diabetic complications. A P-value less than 0.05 was considered significant.

Result: A total of 361 participants were included. The majority of the participants were females 186 (51.5%), in the age group of 30-60 years 225 (62.5%), have type 2 diabetes 303 (83.9%), and knew their diabetes and started treatment for 6-10 years 157 (43.5%) and 161 (44.6%) respectively. Most participants had poor glycemic control 279 (77.3%) with HbA1c level ≥ 7. A total of 120 (33.2%) had experienced diabetic complications where neuropathy was the predominant one 57 (47.5%). The odds of developing diabetic complications was more than twice higher in males [AOR 2.6, 95% CI 1.59,4.25; P ≤ 0.01] and patients with A1C ≥ 7% [AOR 2.34, CI 1.4, 6.3; P ≤ 0.01].

Conclusion: The diabetic complications were high among the diabetic patients in TASH. The majority of patients had poor glycemic control. Chronic microvascular complications particularly neuropathy was the most common. The significant factors predicting the occurrence of complications were male gender and HbA1c ≥ 7%.

Keywords

Diabetes mellitus, Diabetic control, Diabetic complications, Chronic complication, Microvascular complication

Abbreviations

BMI: Body Mass Index; CI: Confidence Interval; DM: Diabetes Mellitus; FBS: Fasting Blood Sugar; HbA1c: Glycated Hemoglobin; IDF: International Diabetic Federation; TASH: Tihkur Anbessa Specialized Hospital

Background

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by hyperglycemia and disturbed metabolism of glucose, fat, and protein. It has emerged as a leading global health problem as the prevalence of DM is rapidly increasing at epidemic levels throughout the world [1-3]. In particular, the economy and health care of low- and middle-income countries are being threatened by the rapid progression of DM. In 2019, about 9.3% of the world population were living with diabetes and this prevalence is expected to increase to 10.2% by 2030 and 10.7% by 2045. Besides, DM is the fourth leading cause of death resulting in an

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estimated 4.2 million deaths globally [4,5].

In Ethiopia, DM is rapidly increasing chronic diseases with a reported prevalence between 2.0-6.5%, the highest prevalence being in Addis Ababa, the capital city [6]. According to the International Diabetes Federation (IDF) report of 2019, the national prevalence of DM in Ethiopia was 3.2% among adults of 20-70 years-old. Besides, Ethiopia stands fourth with DM prevalence in Africa with an estimated 1.7 million people living with DM [5]. Also, a systematic review by Gebreyohannes, et al. reported that an estimated 2.6 million people were living with diabetes in Ethiopia [7].

Although preventable DM complications are major concerns for diabetic patients and the health care system as causes for long-term damage and failure of various organ systems. The major diabetic complications are hypertension, neuropathy, renal diseases, lower extremity amputations, retinopathy, visual disturbances, depression, and cataracts [6-8]. These complications account for increased morbidity, disability, and mortality, and threats for the economies of all countries especially in the middle and low economic countries [9,10]. These complications of DM can be classified as acute or chronic. Acute complications such as diabetic ketoacidosis, hyperglycemic hyperosmolar state, and hypoglycemia account for high morbidity and mortality among diabetic patients and contribute significantly to hospitalization and high costs of diabetes care [9]. Besides, chronic complications of DM are related to damage to small blood vessels (microvascular complications) or large blood vessels (macrovascular complications). Diabetic retinopathy is the most common microvascular complication, followed by diabetic nephropathy and neuropathy. All macrovascular complications arise from the development of atherosclerosis, which gradually causes the narrowing of arterial walls leading to coronary artery disease, stroke, and peripheral vascular disease [9].

The occurrence of DM complications is influenced by intrinsic and extrinsic factors. Different studies identified risk factors having predictive value for DM complications. The commonest risk factors for DM complications were age, body mass index, waist-to-hip ratio, blood pressure, fasting plasma glucose, glycated hemoglobin (HgA1c), lipid profiles, albuminuria, smoking and family history of diabetes, gender, type of DM, duration of illness, medication type, negative attitude towards DM, poor adherence to treatment and knowledge about DM and its management [11-16].

Despite the rapidly increasing burden of diabetes in Ethiopia, there is a dearth of evidence showing the prevalence, and associated factors related to DM complications. For the effective management of DM, it is crucial to generate evidence on diabetic complications and associated factors to enhance the therapeutic benefits and patient's quality of life. Therefore, this study was aimed to assess DM complications and associated factors among diabetes patients on medical follow-up in TiKur Anbessa Specialized Hospital (TASH).

Methods

Study design and setting

A cross-sectional study was conducted at TASH which is the largest teaching and Specialized public hospital in Ethiopia administered under Addis Ababa University, College of Health Sciences. This study was conducted from 14 April 2020 to 24 May 2020.

Study population

The source and the study populations constituted all diabetic patients who had follow-up treatment at the diabetic clinic of TASH and all diabetic patients who had follow-up treatment and fulfilled the inclusion criteria during the study period respectively.

Eligibility criteria

The inclusion criteria for this study were the age of patients 18 and above, voluntary diabetic patients for the interview, and patients who start anti-diabetic drug treatment for at least six months. Pregnant women were excluded from the study.

Study variables

The dependent variable of the study was the occurrence of diabetes complications whereas the independent variables were demographic factors (age, sex, BMI, educational qualification, monthly income, marital status, occupation, place of residence, social habits, physical activity, source of medication), diagnosis (type 1 and type 2), types of medications, duration of the disease and comorbidity.

Sample size and sampling methods

The sample size was calculated using the single population proportion formula. The total sample size required for the study was 344 calculated based on the possible patient load to the clinic. By adding 10% contingency, a total of 361 patients were sampled. A systematic random sampling method was used to recruit samples for the study on each day of the data collection process.

Statistical analysis

After the filled-in forms were checked for completeness of data, cleaned before data entry, and then entered. Data entry and data analysis were carried out using Statistical Package for Social Sciences SPSS version 25. Descriptive statistics such as frequency, percentage, mean and standard deviation (SD) were employed to summarize patients' characteristics and other related information. Univariable binary logistic regression analysis was performed to relate each variable to complications of diabetes. From the

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univariable analysis, those variables with p < 0.2 were selected for multivariable binary logistic regression analysis. Multivariable binary logistic regression analysis was used to assess the predictability of the independent variables of complication and to estimate, 95% confidence intervals (CI) and p-values. The association was declared significant at *p < 0.05*.

Results

Socio-demographic and clinical characteristics

In this study, a total of 361 participants were included. The majority of the participants were females 186 (51.5%), in the age group of 30-60 years 225 (62.5%), and urban residents 334 (92.5%). Regarding the clinical characteristics, most participants were having type 2 diabetic patients 303 (83.9%), who knew their DM states and started treatment for 6-10 years 157 (43.5%) and 161 (44.6%) respectively. The glycemic control was not optimal for most participants 279 (77.3%) with HbA1c level ≥ 7 and 292 (80.9%) and a current FBS level of ≥ 126. Table 1 describes the details of socio-demographic and clinical characteristics.

Table 1: Socio-Demographic and clinical characteristics of Diabetic patients at TASH, Ethiopia, 2020.

Characteristics		Frequency (%)
Gender	Male	175 (48.5)
	Female	186 (51.5)
Age (years)	< 30	39 (10.8)
	31-60	225 (62.5)
	> 61	97 (29.8)
Marital status	Single	54 (15.0)
	Married	26 (72.3)
	Divorced	6 (1.7)
	Widowed	40 (11.1)
Residence	Urban	334 (92.5)
	Rural	27 (7.5)
Educational status	No formal education	66 (18.3)
	Primary	152 (42.1)
	Secondary	86 (23.8)
	Tertiary	57 (15.8)
Type of diabetes mellitus	Type 1	58 (16.1)
	Type 2	303 (83.9)
Duration of diabetes mellitus (years)	< 5	74 (20.5)
	6-10	157 (43.5)
	> 10	130 (36.0)
Duration of treatment (years)	< 5	79 (21.9)
	6-10	161 (44.6)
	> 10	121 (33.5)
Regular exercise	No	175 (48.5)
	Walking	150 (41.5)
	Gym	36 (10)

Diabetic complications

Among the study participants, a total of 120 (33.2%) had experienced diabetic complications. Most of the complications encountered were chronic complications 109 (90.8%) of which neuropathy was the predominant diabetic complication reported 57 (47.5%) followed by nephropathy 26 (21.7%). Figure 1 shows the types of diabetic complications encountered.

Determinant factors associated with diabetic complications

The multivariate binary logistic regression analysis showed that gender and HbA1c had a statistically significant association with the occurrence of diabetic complications. The independent variables associated with the occurrence of diabetic complications were gender (P ≤ 0.01), age above 60 (P ≤ 0.01), type of DM (p = 0.03). As shown in Table 2, poor diabetic control and male gender were determinants for the occurrence of DM complications. The odds of developing diabetic complications were more than twice higher in participants with A1C ≥ 7% than those with HbA1C with lower than 7% [P ≤ 0.01, AOR 2.34, CI 1.4, 6.3] and male participants [P ≤ 0.01, AOR 2.6, CI 1.59, 4.25].

Discussion

Diabetic complications are the major causes of morbidity and mortality, increased hospitalization, and increased health care expenditure for diabetic patients

Social drug use	No	313 (86.7)
	Cigarette smoker	11 (3.0)
	Alcohol	37 (10.3)
BMI	Underweight	15 (4.2)
	Normal	158 (43.8)
	Overweight	131 (36.3)
	Obese	57 (15.8)
Comorbidities	No	179 (49.6)
	hypertension	136 (37.7)
	dyslipidemia	28 (7.8)
	Others*	17 (4.7)
Diabetic medications	OHA	169 (46.8)
	Insulin	122 (33.8)
	Insulin and OHA	70 (19.4)
Other medications	No	126 (34.9)
	Antihypertensive	71 (19.7)
	Statins	118 (32.7)
	Others**	46 (12.7)
FBS	< 126	69 (19.1)
	≥ 126	292 (80.9)
Hba1c	< 7	82 (22.7)
	≥ 7	279 (77.3)

*Pulmonary disease, heart disease   OHA: Oral Hypoglycemic Agents; **ACE inhibitors, Beta-blockers amitriptyline, antiplatelet.

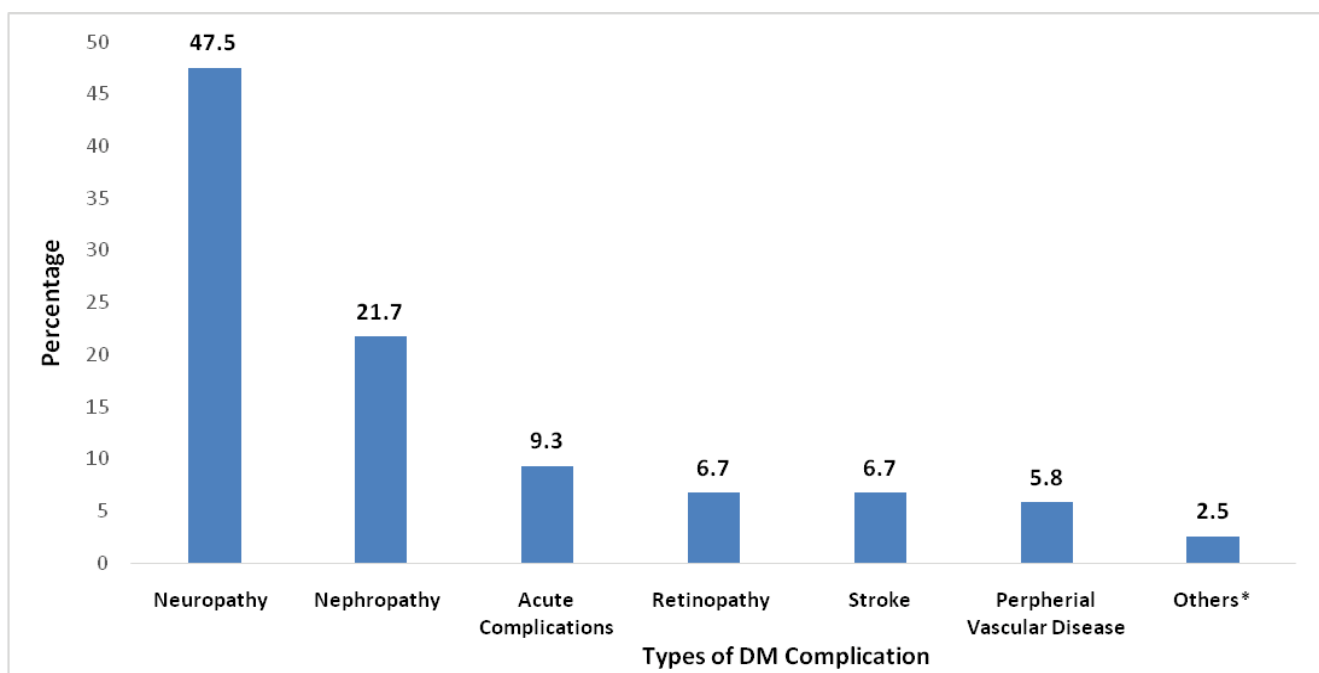Gedamu et al. Int J Diabetes Clin Res 2022, 9:160

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Figure 1: Types of diabetic complications among diabetic patients at TASH, Addis Ababa, Ethiopia (N = 120).

*diabetes foot ulcer, angina, myocardial infarction.

despite they are largely preventable and optimally treated. Hence, identifying the complications among diabetic patients is paramount to improving diabetes management. This study is, therefore aimed to assess the prevalence of diabetic complications and the predictor among diabetic patients attending follow-up at the diabetic clinic of TASH.

In this study, about half (50.4%) of the participants had comorbidities related to DM, hypertension being the most common comorbidity found in 37.7%. Our finding is similar to a study by Sheleme, et al. that reported 39.1% comorbid hypertension in Jimma Referral Teaching Hospital [17]. However, this finding is lower than 69.1% hypertension comorbidity by Negash, et al. in Addis Ababa [18]. The development of macrovascular complications and increased cardiovascular death is higher in patients with the coexistence of DM and hypertension.

Poor glycemic control is common among diabetic patients. In our study, the majority of our participants had poor diabetic control as indicated by higher FBG level above 126 mg/dl in 80.9% and A1C level ≥ 7% in 77.3% of study participants. This finding is in line with similar studies that reported poor glycemic control among diabetic patients in 72.1% in Jimma [17], 64.1% in Adama [19], 60.5% in Gondar [20], 64.1% in public hospitals of Western Ethiopia [21], 59.5% in West Ethiopia [22] and 55.3% of patients in Amhara region referral hospitals [23]. Poor glycemic control contributes to the higher prevalence of chronic diabetes complications [24]. Our findings also revealed poor glycemic control was a predictor of the occurrence of DM complications in our study participants.

This study revealed that 33.2% of diabetic patients had experienced at least one complication. This is comparable with findings that at least one complication was reported in 34.5% of type 2 diabetic patients in China [25], 31.3% in Northwest Ethiopia [20], and 38.5% of diabetic patients in Southwest Ethiopia [17]. In contrast, our finding is lower than a study by Agalu, et al. in Dessie, Ethiopia where 59.7% of patients reported at least one diabetic complication [26] and 53.5% major DM complications [27]. The variation in the prevalence of diabetes complications among studies might be differences in the participants' demographic characteristics, the type of diabetic complications assessed, and the difference in glycemic control.

Our study found that 90.8% of diabetic complications encountered were chronic complications of which neuropathy was the predominant 47.5% followed by nephropathy 21.7%. This finding was comparable with other similar studies in Ethiopia that reported microvascular complications as the most common chronic complications of DM [18,21]. In addition, our study finding is also similar to a study in Sri Lanka by Arambewela, et al. where neuropathy was 62.6%, and nephropathy 50.8% were the most common DM complications [28]. A high prevalence of chronic microvascular DM complications was also reported by a systematic review conducted in Northern Africa [24].

According to our study result, poor glycemic control (HbA1C ≥ 7%) and male gender were predictors for the occurrence of DM complications. The odds of developing diabetic complication were more than twice 2.6 times higher in males and 2.34 times higher in participants with A1C ≥ 7%. A study by Fasil, et al.

Table 2: Bivariate and multivariate logistic regression analysis of determinant factors associated with diabetic complications at TASH, Addis Ababa, Ethiopia.

Variables		Diabetic Complications, n (%)		Bivariate logistic regression		Multivariate logistic regression		
		Yes	No	COR	P-Value	AOR	(95%CI)	p-value
Gender	Female	43 (23.1)	143 (76.9)	1		1		
	Male	77 (44)	98 (56)	2.6	≤ 0.01	2.6	(1.59, 4.25)	≤ 0.01*
Age	< 30	7 (17.9)	32 (82.1)	1	-	-	-	0.426
	30-60	69 (30.7)	156 (69.3)	0.5	0.11	0.806	(0.3, 2.2)	0.670
	> 60	44 (45.4)	53 (54.6)	0.3	≤ 0.01	0.585	(0.21, 1.7)	0.316
Marital status	Single	15 (27.8)	39 (72.2)	1	-		-	-
	Married	85 (32.6)	176 (67.4)	0.8	0.39		-	-
	Divorced	3 (50)	3 (50)	0.4	0.27		-	-
	Widowed	17 (42.5)	23 (57.5)	0.5	0.14		-	-
Residence	Urban	111 (33.2)	223 (66.8)	1			-	-
	Rural	9 (33.3)	18 (66.7)	1.0	0.99		-	-
Educational status	No formal education	22 (33.3)	44 (66.7)	1	0.33		-	-
	Primary	58 (38.2)	94 (61.8)	0.8	0.5		-	-
	Secondary	24 (27.9)	62 (72.1)	1.3	0.47		-	-
	Tertiary	16 (28.1)	41 (71.9)	1.3	0.53		-	-
Type of Diabetes Mellitus	Type 1	12 (20.7)	46 (79.3)	1			-	-
	Type 2	108 (35.6)	195 (64.4)	0.47	0.03	0.52	(0.23, 1.18)	0.12
Duration of Diabetes Mellitus (years)	< 5	22 (29.7)	52 (70.3)	1	0.01		-	0.93
	6-10	41 (26.1)	116 (73.9)	1.2	0.57	1.2	(0.23, 6.6)	0.81
	> 10	57 (43.8)	73 (56.2)	0.5	0.05	0.94	(0.11, 8.20)	0.96
Duration of Treatment (years)	< 5	23 (29.1)	56 (70.9)	1	0.01		-	0.92
	6-10	43 (26.7)	118 (73.3)	1.1	0.7	0.84	(0.16, 4.4)	0.84
	> 10	54 (44.6)	67 (55.4)	0.5	0.03	0.65	(0.08, 5.50)	0.69
Regular exercise	Yes	51 (34)	99 (66)	1			-	-
	No	69 (32.7)	142 (67.3)	1.1	0.8		-	-
Social drug use	Yes	19 (39.6)	29 (60.4)	1			-	-
	No	101 (32.3)	212 (67.7)	1.4	0.32		-	-
BMI	Underweight	2 (13.3)	13 (86.7)	1	0.44		-	-
	Normal	56 (35.4)	102 (64.6)	0.28	0.1		-	-
	Overweight	43 (32.8)	88 (67.2)	0.32	0.14		-	-
	Obese	19 (33.3)	38 (66.7)	0.31	0.15		-	-
Comorbidities	Yes	71 (39)	111 (61.0)	1			-	-
	No	49 (27.4)	130 (72.6)	1.7	0.02	1.5	(0.92, 2.5)	0.10
FBS	< 126	18 (26.1)	51 (73.9)	1			-	-
	≥ 126	102 (34.9)	190 (65.1)	0.66	0.16	1.3	(0.6, 2.6)	0.52
HbA1c	< 7	13 (15.9)	69 (84.1)	1			-	-
	≥ 7	107 (38.4)	172 (61.6)	2.3	≤ 0.01	2.34	(1.4, 6.3)	≤ 0.01*

found that poor glycemic control is a predictor of DM complication [20]. In contrast, a study by Gebre and Assefa found that the significant factors associated with diabetic complications were divorced marital status, poor glycemic control, body mass index > 25, and duration of illness [29]. Another study also reported that Age of the patient, family history of DM, duration of illness and medication therapy, and comorbidities were significantly associated [14].

Limitations of the Study

As this study is based on a cross-sectional study design, it is impossible to assess the causality. Participants might express social desirability biases during the interview.

Conclusion

The diabetic complications were high among the

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patients on diabetic clinic follow-up in TASH. The majority of patients had poor glycemic control and hypertension as a comorbid disease. Most of the complications were chronic microvascular complications. The significant factors predicting the occurrence of complications were male gender and HbA1c ≥ 7%.

Acknowledgments

Author Contributions

CM and MG conceptualized the study and designed the methods, conducted the study, analyzed data and wrote the result. MG and MF supervised the study, transcribed and analyzed the data and prepared manuscript. MF reviewed the manuscript. All authors read and approved the final manuscript.

Declarations

Ethical consideration

Ethical approval of the study protocols was granted from the Ethical Review Committee (ERC) of the School of Pharmacy, college of Health sciences, Addis Ababa University. Before data collection, informed verbal consent was obtained from the study participants. The confidentiality of study participants was assured by removing personal identifiers from the questionnaire and keeping the collected data in a secure place. Besides, this study was conducted following the Helsinki declaration.

Consent for publication

Consent for publication is not applicable as our manuscript does not contain any personal data.

Declaration of conflicting interests

The authors have no conflicts of interest to declare.

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Data availability

The data supporting the finding of this study will be made available upon request from the corresponding author.

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