Magnitude and Factors Associated with Chronic Type 2 Diabetic Complication in Governmental Hospital; Evidence from Harar Hospital, East Ethiopia

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Abstract

Background: World Health Organization (WHO) estimates 8.3% of the world population are living with diabetes in the world with 4.7% of them living Africa. The global prevalence of people with diabetes is increasing with similar trend of increment of cases in Africa including Ethiopia. Such information is however limited where the study was done and therefore, we assessed the magnitude of the problem and predictors of chronic complications among patients that had a follow up at Harar governmental Hospital diabetic clinic.

Methods: A facility based cross-sectional study was conducted among diabetic patients attending the diabetic clinic of Harar governmental referral Hospital from May 1 to 31, 2021. All diabetic patients who visited the clinic during the study period were included. Data were collected from all patients using interview guided tools and chart review. The data were then cleaned, coded, and entered into SPSS for windows version 17.0 for analysis. Binary logistic regression model was employed to identify the prediction of diabetic complication. A 5% significance level was used for the inferential statistics to guide statistical significance with 95%CI of the crude and adjusted odds ratio. The final model fitness was tested using Omnibus Tests of Model Coefficients and Hosmer and Lemeshow Test.

Result: A total of 214 participants were included in this study. The mean age of participants was 54.5 +/-(9.5) years. Less than half (47.3%) were in the age group of 41 to 60 years. Nearly one-third (31,0%) of them had one or more chronic complications. Duration of diabetes of 10 years or more (AOR = 0.20; 95%Cl = 0.098 - 0.438), had history of hypertension (AOR = 0.20; 95% Cl = 0.093 - 0.431) and cigarettes smoking (AOR = 0.27; 95%Cl = 0.095 - 0.810) where the major predictors of chronic complications. Whereas age, family history of DM, BMI status had no association with the presence of complication in our assessment.

Conclusion: Almost one in three of the study participants had chronic complications of diabetes. To reduce the issue under caption and achieve good glycemic control, targeting the aforementioned predictors through appropriate life style changes, early detection and treatment of Diabetes is recommended.

Keywords: Diabetic Complications; Magnitude; Association Factor; Harar Regional Hospital; East Ethiopia

Magnitude and Factors Associated with Chronic Type 2 Diabetic Complication in Governmental Hospital; Evidence from Harar Hospital, East Ethiopia

02

Abbreviations

AAU: Addis Ababa University; AOR: Adjusted Odd's Ratio; FMOH: Federal Ministry of Health; BMI: Body Mass Index; IDF: International Classification of Functioning; WHO: World Health Organization; CI: Confidence Interval; HbA1c: Glycated Hemoglobin; SPSS: Statistical Package for Social Sciences

Background

According to World Health Organization (WHO) estimates, 342 million people (8.3% of the world population) are living with Diabetes Mellitus (DM) globally with the highest (4.7%) numbers of cases from Africa [1]. The global prevalence of DM is expected to increase from the current 463 million to 578 million in 2030 and 700 million in 2045 with similar trend of increment of cases in Africa including Ethiopia [1]. Surprisingly most (69.2%) of adults living with DM are unaware of their conditions. Based on the International Classification of Functioning (IDF) report for Africa, there were 2,567,900 adult DM patients in Ethiopia in 2015[1]. Another local study conducted documented the number of DM cases has risen from 108 million in 1980 to 422million in 2014 [2].

The highest numbers of DM case in Africa include Nigeria (3.9 million), South Africa (2.6 million), Ethiopia (1.9 million), and the United Republic of Tanzania (1.7 million in Africa, 21.5 million with an alarming annual estimate of 480,900 diabetes related deaths (Federation, 2013). Other African countries with alarming rate of prevalence are the island of Reunion (15.4%), followed by Seychelles (12.1%), Gabon (10.7%) and Zimbabwe (9.7%) regardless of their population size [3,4]. The primary concern of DM is its complications which ranges from macro vascular related (coronary artery disease, peripheral vascular disease, and stroke) and micro vascular complications (Diabetic nephropathy, diabetic retinopathy, and peripheral neuropathy) [4]. Its complications account for increased morbidity, disability, and mortality and threats for economies of all countries especially in the middle and lower economic country. In 2016, an estimated 1.6 million deaths were directly caused by diabetes. Another 2.2 million deaths were attributed to high blood glucose in 2012.

A multinational study done among 28 countries reported 27.2% and 53.5% macro- and microvascular complications, respectively. The Chinese study also identified 76.4% of DM patients to have at least one kind of complication. In sub-Saharan Africa, ocular complication was found in 14 -18% and signs of neuropathy in up to 48%. In Ethiopia, 29.4% of people with diabetes have experienced at least one chronic complication such as neuropathy (20.5%), retinopathy (19.8%) and chronic kidney disease (4.6%) as the three most common chronic complications [2].

There have been various factors proved to be significantly associated with chronic diabetic complications ranging from sociodemographic [5-7], behavioral [8] to clinical factors [9]. Such information however was unavailable in the studied are and thus we examined the magnitude and the factors associated with DM complication for future evidence-based intervention in the country in general and in particular to the studied region.

Methods

Study design, setting and period

A Facility based cross-sectional study was conducted among diabetic patients who have a medical follow up at Harar governmental Hospital from May 1 to 31/2021. The hospital is 525 kilo meters East of Addis Ababa, the capital city of Ethiopia. At the time of the study, there were 211 health workers providing in-patient and outpatient services. The hospital has different clinics among which the diabetic clinic is established long ago and dedicated to serve all referred diabetic patients and hospital clients twice a week.

Study participants

The main eligibility criteria for enrollment of patients were age of > 18 years that had established DM that had a follow-up for more than 3 months. Patients newly diagnosed and on treatment for less than 3 Months; had type 1 DM; acutely sick; refused to participate were excluded.

Magnitude and Factors Associated with Chronic Type 2 Diabetic Complication in Governmental Hospital; Evidence from Harar Hospital, East Ethiopia

03

Sample size and sample technique

The sample size was determined using a single population proportion formula with the assumptions of a 95% level of confidence, a 5% margin of error and a proportion value of 50%, since we could not find any previous studies conducted in the region to determine the magnitude of the DM. Based on these assumptions, a sample size of 384 was obtained. Using a correction formula for a finite population of approximately 400, with 10% non-response rate, the final sample size was inflated to 215. A consecutive sampling technique was used to select the participants till the sample size was reached.

Data collection process and instrument

Data was collected by health workers (HWs) with a minimum of BSC. Prior to data collection, all health workers who served as data collectors were trained for 2 days on the objective of the study and interviewing techniques to standardize their method of data collection. All type 2 diabetic patients visiting the diabetic follow up clinic during the study period were interviewed by the trained HWs after their consent was obtained using a pre-tested tools containing socio-demographic, clinical characteristics individual lab tests findings and type of medications used. In addition, adherences to the medications as well as diabetic complications were also assessed to determine the contributory factors to the patient's complications based on chart review Each patient were informed one month in advance before the next visit of appointment to get tested for their Fasting blood sugar at the cost of the study.

Measurements: We used a Seca 755 Column Medical Scale for measurement of body weight with an accuracy of 0.1 kg and a standard stadiometer for heights of about 0.1 cm. While recording weights, the patients wore light clothing, and during height measurements, shoes were taken off. Weight divided by height squared (kg/m^2) was used for the BMI calculation. A BMI between 18.5 to 24.9 kg/m^2 was considered normal while ≥ 25 kg/m^2 was determined as overweight and obesity was defined as BMI ≥ 30 kg/m^2.

The collected data were checked every day for completeness and consistency.

The cleaned data were then entered into a computer using Statistical Package for Social Science (SPSS) for windows version17. Descriptive statistics was computed to determine the frequency of the problem.

Binary logistic regression model was used to find the factors associated with diabetic complication. A 5% significance level was used for the inferential statistics to guide statistical significance with 95%CI of the crude and adjusted odds ratio. The final model fitness was tested using Omnibus tests of model coefficients and Hosmer and Lemeshow test.

Results

Socio-demographic and clinical characteristics of the study participants

Of the total 215 estimated sample size, 214 study participants were enrolled with 100 percent response rate. Eighty-six (49.4%) of them were males. The mean age was 54.5 (9.5) with nearly two-thirds (62.6%) of them were aged between 41 to 60 years. Slightly over one-third (34.5%) had attained at least primary school education. In terms of occupation, 156 (72.9%) were formally employed. Slightly over half (53.3%) had a healthy BMI. Over two-thirds (68.7%) had smoking habits for over 10 years and above and 36 (16.8%) of them had a positive family history of diabetes. Hypertension was present in 81 (37.9%). The mean (SD) diabetes duration was 7.8 (5.9) years and 146 (68.3) had duration of greater or equal to 10 years. Regarding their blood glucose level; 130 (60.9%) had FBG > 130 mg/dl (Table 1).

Prevalence of DM complications and type of medication used

As shown in table 2, 67 (31.3%) had one or more chronic diabetes complication. The microvascular type of complications such as diabetic neuropathy which was found in 18 (8.2%), retinopathy and nephropathy were found in 16 (7.3%) and 10 (4.5%), respectively

Magnitude and Factors Associated with Chronic Type 2 Diabetic Complication in Governmental Hospital; Evidence from Harar Hospital, East Ethiopia

04

Variables	Frequency	Percentage (%)
Sex		
Male	106	49.5
Female	108	50.5
Age (in years)		
18 - 40	12	5.6
41 - 60	134	62.6
> 60	68	31.7
Educational status		
Had no formal education	88	40.8
At least primary schooling	126	59.2
Occupation		
Not formally Employed	58	27.1
Formally Employed	156	72.9
BMI (kg/m²)		
Desirable or healthy BMI	114	53.3
Overweight	100	46.7
Duration of smoking habits		
< 10 years	67	31.3
10 years and above	147	68.7
Had family history of DM		
Yes	36	16.8
No	178	83.1
Presence of Hypertension		
Yes	81	37.8
No	133	62.2
Duration of DM		
< 10 years	67	31.3
10 years and above	147	68.7
Mean (SD)	7.8 (5.9) yrs	
FBS level		
Less or equal 130 gm/dl	84	39.3
Above 130 gm/dl	130	60.7

Table 1: Socio-demographic and clinical characteristics of respondents that were on follow up at Harar Governmental Referral Hospital East Ethiopia, 2021 (n = 214).

Magnitude and Factors Associated with Chronic Type 2 Diabetic Complication in Governmental Hospital; Evidence from Harar Hospital, East Ethiopia

05

and were the most common. The macrovascular complications like ischemic heart disease was present in 22 (10.2%). Diabetic foot ulcer was identified in 1 (0.5%) of participants.

Regarding the medications used, 122 (56.7%) of them were on a metformin and glibenclamide combination, 35 (16.2%) were on metformin monotherapy and 5 (2.7%) were on glibenclamide monotherapy. Insulin injection was given to 39 (18.1%). The combination of oral anti-diabetes medications and insulin were prescribed in 13 (6%) of them.

Variable	Frequency (%)	Percentage (%)
Chronic complications		
No	147	(68.6)
Yes	67	(31.3)
Type of Complications		
Neuropathy	18	(8.2)
Retinopathy	16	(7.3)
Nephropathy	10	(4.5)
Ischemic heart Disease	22	(10.2)
Foot ulcer	1	(0.5)
Type of Medications		
Glibenclamide plus Metformin	122	(56.7)
Insulin	39	(18.1)
Metformin	35	(16.2)
Insulin plus Metformin	13	(6.0)
Glibenclamide	5	(2.7)
Total	100.0	

Table 2: Prevalence of chronic DM complications and medications used among study participants at governmental Hospital, Harar East Ethiopia, 2021.

Table 3 displays the factors associated with chronic diabetic complication (CDMC). Chronic diabetic complication was crudely associated with respondent's age, having formal employment, hypertension, smoking habit, duration of diabetic of 10 years and above and regularly taking the prescribed anti diabetic medications.

Nonetheless, in the multivariate analysis, only hypertension, smoking, and duration of diabetics retained their significant association with CDMC. The odds of developing CDMC were 80.0% more in patients who had DM for more than 10 years than their counter groups (AOR = 0.20; 95%Cl = 0.098 - 0.438). Likewise, the odds were 73.0% among smokers than non-smokers (AOR = 0.27; 95%Cl = 0.095 - 0.810) and the odds was respondents of [AOR = 0.20(95%Cl: 0.093 - 0.43) among respondents that had hypertension their referent groups.

Age of the patients, family history of DM, glucose control level, BMI result, specific DM drugs were observed to have no significant association in our assessment.

Magnitude and Factors Associated with Chronic Type 2 Diabetic Complication in Governmental Hospital; Evidence from Harar Hospital, East Ethiopia

06

Characters	COR (95% CI)	p-value	AOR (95% CI)	p-value
Age				
<45	1	0.001	1	0.118
> = 45	1.05 (1.02-1.08)		1.03 (0.99-1.07)	
Sex				
M	0.78 (0.43-1.40)	0.40	1.32 (0.61-2.86)	0.482
F	1		1	
Formal education				
Yes	0.88 (0.45-1.47)	0.48	0.88 (0.32-2.36)	0.795
No	1		1	
Employed				
Yes	0.36 (0.19-.67)	0.001	0.77 (0.28-2.03)	0.593
No	1		1	
BMI				
Normal	1	0.26	0.86 (0.41-0.81)	0.694
Overweight	1.40 (0.78-2.52)		1	
DM family history				
Yes	1	0.73	1	0.405
No	0.87 (0.39-1.92)		0.66 (0.25-1.75)	
Hypertension				
Yes	1	0.001	1	0.001
No	0.19 (0.10-0.36)		0.20 (0.09-0.43)	
FBS				
<130	1	0.39	1	0.991
> = 130	1.31 (0.71-2.41)		0.99 (0.46-2.15)	
Smoking				
Yes	1	0.01	1	0.019
No	0.34 (0.15-0.771		0.28 (0.09-0.81)	
DM duration				
< 10 years	1	0.001	1	0.001
> = 10	0.17 (0.09-.32)		0.21 (0.09-0.44)	
Medication usage				
Yes	1	0.01	1	0.295
No	0.69 (0.51-.91)		0.82 (0.57-0.18)	

Table 3: *Factors associated with chronic diabetic complication among diabetic's patient in Harar governmental referral hospital, 2021. DM = Diabetes Mellitus; FBS = Fasting Blood Sugar.*

Magnitude and Factors Associated with Chronic Type 2 Diabetic Complication in Governmental Hospital; Evidence from Harar Hospital, East Ethiopia

07

Discussion

The magnitude of chronic DM-related complications (CDMC) and its contributory factors that would result in many disabilities affecting the quality of life of patients and increase the burden on the healthcare system was assessed. Accordingly nearly one in third of our patients had chronic complication ranging from Diabetic neuropathy, Retinopathy and nephropathy, ischemic heart disease and Diabetic foot ulcer. The major contributory factors identified were hypertension, smoking, and duration of diabetics.

When we look at the magnitude of CDMC observed our findings is comparable with Gondar Hospital which reported 31.3% of patients to have one form of complications [15]. On the other hand compared with some other previous local studies done in Jimma [17], Dessie % [18] which documented 62.0% and 59.5, respectively as well as elsewhere like 52.0% in China [19] and Saudi Arabia of 42.7% [16], our report is lower. Such discrepancies might have occurred due to level of the skill of the general practitioners skill in diagnosing and the sociocultural difference in health seeking behavior.

The aforementioned occurrences of CDMC that included neuropathy, retinopathy in and nephropathy were concordant with the study finding of the University of Gondar Hospital findings [15] as well as in India [20] and Pakistan [21].

In this study, patients who have lived with diabetes for more than or equal to 10 years were more likely to develop CDMC compared with those with less than 10 years of duration. In accordance with our finding, the studies conducted in the Bangladesh showed a significant association between chronic diabetes complications and duration of diabetes [22]. In the same manner, the Kuwait study also documented longer the duration of diabetes as among the major risk to develop chronic complications [23]. The same study further stated that the risk of developing complications was double among patients who had diabetes for duration of 10 to 19 years as compared to those who had less than 10 years and it was triple among those who had diabetes for 20 or more years. The longer duration of uncontrolled diabetes deserves the attention since it increases the risk of damaging the blood vessels which consequently lead to heart attack and stroke, and affects the kidneys, eyes, feet and nerves among others [24].

Patients who had hypertension were more likely to develop diabetes related chronic complications than the referent groups and the findings are concordant the Gondar Referral Hospital in Ethiopia which identified that the presence of hypertension as an independent predictor for the occurrence of diabetes complications [25]. Similarly, the Saudi Arabian study also asserted the issue as one of the major contributory factor to develop DMRC in half of the patients [26]. It is apparent that that in uncontrolled diabetes, hypertension increases the risk of microvascular complications occurrence, especially for nephropathy [27] and thus managing blood pressure is crucial because it can prevent or delay the onset of diabetes complications among people with diabetes [13].

As expected our study has shown patients who smoked cigarette were more likely to develop diabetes related chronic complications than their counter groups. Such observations were also documented among adult diabetic patients in a Tertiary Hospital from northeast Ethiopia [18]. In order to avert the situation of CDMC, it is good to counsel patients timely on modifiable risky behavior that exposes patients to undesirable complications.

The occurrence of CDMC observed among patients with uncontrolled blood glucose than their referent groups was slightly higher though the difference was not significantly. Similar findings were documented by the Gonder team [15]. Therefore, achieving good glycemic control and managing factors like blood pressure could prevent or delay the onset of diabetes complications since such approach is the most effective way to prevent or delay the occurrence of chronic complications [13,14].

Strength and Limitations of the Study

This study is the first of its kind using a standardized tool for assessing the predictors of chronic DM complications in the region contextually with 100 percent response rate. It further elucidated key factors that need subsequent the attention of the FMOH and the

Magnitude and Factors Associated with Chronic Type 2 Diabetic Complication in Governmental Hospital; Evidence from Harar Hospital, East Ethiopia

08

regional health bureaus. Nonetheless, the study had some limitations due to the nature of the study design, cause-effect relationships and outcomes of DM complications cannot be established. Other than this, clinical findings from chart review and were used to determine to obtain the diagnosis of chronic complications. It should be noted that missed or undocumented diagnosis could cause underreporting of the complications. Moreover, since HbA1 test was not done due to unavailability of the reagent, we did not determine the association between the level of blood glucose control and the occurrence of DM complication.

Conclusion

The magnitude of chronic diabetic complications (CDMC) was 31.3%. Diabetic neuropathy was the most commonly identified chronic complication, followed by diabetic retinopathy and nephropathy. The presence of hypertension, smoking habit and duration of the illness were significantly associated with CDMC. To reduce the issue under caption and achieve good glycemic control, targeting the aforementioned predictors through appropriate life style changes such as advice to stop the cigarette smoking, early detection and treatment of Diabetes is strongly recommended.

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Authors' Contributions

Dr. Haidar Mohammed was responsible for project inception and has collected the data and drafted the manuscript as part of his fulfillment for specialty in family medicine; while Dr Sawra supervised the work. Professor Jemal Haidar critically reviewed the manuscript for the intellect. All authors readand approved the final manuscript.

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Availability of Data and Materials

All data generated or analyzed are included in this published article.

Ethics Approval and Consent to Participate

Ethical clearance was obtained from the Department of Family medicine, School of Medicine, and Addis Ababa University. The management of the hospital was communicated for approval of the study through formal letter from Addis Ababa University. In addition, informed written consent was also obtained from each study participant after being introduced to the purpose of the study and informed about their rights to interrupt the interview atany time. Confidentiality was maintained at all levels of the study.

Consent for Publication

Not applicable.

Competing Interests

The authors declare that they have no competing interests.

Magnitude and Factors Associated with Chronic Type 2 Diabetic Complication in Governmental Hospital; Evidence from Harar Hospital, East Ethiopia

09

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Magnitude and Factors Associated with Chronic Type 2 Diabetic Complication in Governmental Hospital; Evidence from Harar Hospital, East Ethiopia

10

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