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Prevalence of Retinopathy and its Associated Risk Factors among Diabetic Patients Attending at Biet-Mekae Community Hospital

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Abstract

Introduction: Diabetic Retinopathy is most feared eye complications among diabetic patients. Its difficulty to treat and asymptomatic until the end stage, making it the most threatening condition. Therefore, determining the prevalence of retinopathy and identifying possible risk factors associated with it among predisposed population is very crucial. So, this study aimed to determine the prevalence of retinopathy and factors associated with the disease among diabetic patients in Asmara, Eritrea.

Methodology: The study was a cross-sectional hospital-based study conducted at Biet-mekae community Hospital from September 2018 to April 2019. A standard questionnaire was used to capture data about the demographic, anthropometry and medical conditions of study participants. Visual acuity, degree of retinopathy, blood pressure measurement and lipid profile of participants were recorded in a checklist. Double data entry was done to maintain data quality and analysis was done using SPSS Version 26. Descriptive statistics were displayed using tables and multivariable logistic regression was used to identify variables significantly associated with the presence of Diabetic retinopathy.

Result: The prevalence of retinopathy among diabetic patients was 41%. The mean age of respondents was 57+13. More females than males were affected by diabetic retinopathy (60.8% versus 39.2%). In the inferential statistics age, years lived with diabetes, triglyceride levels, and exercise time were significant predictors of diabetic retinopathy.

Discussion: A high prevalence of diabetic retinopathy among diabetic patients was identified in this study. The results of inferential statistics were congruent with the findings of other studies. The odds of diabetic retinopathy increase with the progression of age and years lived with diabetes mellitus. Triglycerides level above 200 are also a significant predictor of DR. similar finding was reported in Ethiopia, Pakistan, India, Nepal, and, Sudan. Routine health education about the management of diabetes and retinopathy would help to reduce the risk of retinopathy among diabetic patients. Further research using a fundas camera is needed to assess the prevalence and factors that drive the occurrence of retinopathy among the diabetic population in Eritrea.

Keywords: Diabetes mellitus; Diabetic retinopathy; Proliferative DR; Non-proliferative DR; HgbA1c

Introduction

Globally, the burden of diabetes mellitus is rising rapidly creating enormous socioeconomic and health challenges [1]. Globally, 415 million people were living with diabetes mellitus in 2015 and this number is projected to reach 642 million by 2040 [2]. However, this increase is unevenly distributed among all countries of the world. The number of people living with diabetes in sub-Saharan Africa is projected to increase by +109% from 19.8 million in 2013 to 41.4 million in 2035, as Sub-Saharan Africa (SSA) is a region gripped by a high rate of communicable diseases like HIV and malaria, epidemics of non-communicable disease such as diabetes is a looming great public health crisis [3-6]. Diabetic retinopathy (DR) is one of the biggest causes of irreversible blindness in the world [3]. Among people of productive age, it's one of the most feared complications for diabetic mellitus. Approximately 80% of DM type 2 patients and 97% of DM type 1 patients will develop some degree of retinopathy after living 15 years with diabetes [4,5]. Diabetic retinopathy is the leading cause of blindness among 20 to 64 years old American, causing 8000 new cases of blindness every year [3].

Globally, diabetic retinopathy is prevalent in 34.6% of diabetic patients [2] and it is the culprit behind 4.8% of the cases of blindness in the world [6]. From 1990 to 2010, diabetic retinopathy was ranked as the fifth most common cause of preventable blindness and the fifth most common cause of moderate to severe visual impairment [7]. Of an estimated 285 million people with diabetes in 2010, a third had signs of DR, and a third of them were affected with vision-threatening diabetic retinopathy (VTDR), which is defined as severe non-proliferative DR, or proliferative DR (PDR), or the occurrence of diabetic macular edema (DME) [8].

Several studies have shown that factors such as type and duration of diabetes, age, gender, glycemic control, hypertension, body mass index (BMI), smoking, serum lipids, and microalbuminuria are associated

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with the development and progression of DR [9,10]. Regular screening of diabetic patients might help to develop time management strategies and reduce complications and vision loss [10] as some risk factors are modifiable. Some studies even suggest that appropriate treatment can decrease the loss of vision caused by proliferative DR by up to 90% [11]. Understand the real burden of DR and associated risk factors is essential to diagnose promptly, introduce proper management, and, prevent visual impairment and blindness. Thus, this study aims to analyze the prevalence of diabetic retinopathy and the factors associated with it in Biet-Mekae Community Hospital.

Methodology

Study setting

This study was conducted at Biet-Mekae community hospital, in Asmara, Eritrea. It is one of the few hospitals that serves the demand of people with ocular problems. It also serves patents with major chronic illnesses such as Diabetes Mellitus, hypertension, making it the most suitable place for this study.

Study population

All diabetic patients who were enrolled at the Non communicable Diseases clinic in the hospital were the target population of this study.

Sample size

Sample size was determined using the formula

$$n1 = \frac{Z^2 * P * Q}{D^2}$$

Where,

Z = the value of the standard normal variable corresponding to 95% level of significance,

P = Estimated prevalence

Q = 1-P,

D = margin of error at 5% (standard value of 0.05).

We assumed the prevalence of diabetic retinopathy to be 50% among the study population, so

N = (1.96)2 (0.5) (0.5)/ (0.05)2,

0.9604/0.0025

N = 384.16~ 384.

$$n2 = n1 * \frac{\text{(Total study population)}}{\text{(Total study population +N)}}$$

The Study population was estimated to be 450

N2= 384 (450/ (384+450))

N2= 207

To account for loss of power of this process, we used design effect of 1.4 and accounting for non-response rate of 5%, the final sample size becomes 304.

The study was a hospital-based study done in Biet Mekae community Hospital, Asmara, Eritrea from September 2018 to April 2019. Patients who had corneal opacity and cataracts were excluded from the study.

Data collection tool

A questionnaire was used to capture the demographic and medical history of patients. Anthropometric and blood pressure measurements were taken and eye examinations were recorded on a checklist. Venous blood was collected for laboratory analysis. The laboratory variables collected in this study were total cholesterol, triglyceride (TG), high-density lipoprotein (HDL), low-density lipoprotein (LDL), fasting blood sugar (FBS), and, HgA1C. For grading diabetic retinopathy, the international clinical diabetic retinopathy disease severity scale of the American Academy of Ophthalmology (AAO) was used.

Data processing and analysis

The data collected was cleaned on the spot by the supervisor and data manager. Data entry was done by double data entry using cspro v7.02. The data was then exported to SPSS version 26 for analysis. Descriptive statistics are displayed using tables and logistic regression was used for inferential statistics. Bivariate and multivariable logistic regression was used to find the association between predictor and outcome variables. The outcome variable was the presence or absence of diabetic retinopathy (coded as 1=presence of Retinopathy, 0=absence of Retinopathy). Multi-collinearity analysis was done to assess the suitability of variables to include in the model. Variables with multi-collinearity values above 5 were excluded from further analysis. Bivariate analysis was done to identify variables to include in the final model. To control the effect of confounders all variables with a p-value less than 0.2 in the bivariate analysis were included in the multivariable model. Results of multivariable logistic regression were reported as adjusted odds ratio (AoR) with a 95% confidence interval. Variables with confidence intervals not crossing the value of 1 were considered significant.

Results

In this study a total of 300 diabetic patients were considered and 293 study participants had completed data yielding 96% response rate. The remaining 7 cases were excluded as they had fully matured cataracts.

Of the total participants, 59% had no retinopathy in both of their eyes and 13.3% of the participants had retinopathy in one of their eyes. The occurrence of retinopathy in both eyes was identified in 27.6 % of the study subjects (Table 1). Collectively, the prevalence of retinopathy among the diabetic patients who attended the NCD clinic of Biet-Mekae Hospital was 41% (Table 1).

Results are comparable for both eyes and no apparent diabetic retinopathy was found in 61% of the left eye and 61.7% of the right eye. Mild non-proliferative diabetic retinopathy was diagnosed in 14.3% of the right eye and 14% of the left eye. Similarly, 13.3% of the left eyes and 14.7% of the right eyes had moderate NPDR. The proportion of

Table 1: Occurrence of Retinopathy.

DR condition	Categories	Frequency	Percent
DR absent		173	59%
DR present			
	Unilateral	39	13.30%
	Bilateral	81	27.60%
	Total	**120**	**41%**
Total		**293**	**100%**

left eye with severe NPDR and proliferative DR was 3.0% and 2.3% respectively. Severe NPDR and proliferative DR each were diagnosed in 2.7% of left eyes. In general, almost 41 % of the total diabetic patients who participated in the study had DR in either of their eyes (Table 2).

Diabetic Retinopathy according to Socio-demographic Characteristics

Majority of study participants were females (60.8%). The mean age of participants was 57+13 (males 59+13.22 vs female56+12.7). More than half (53.3%) were married while those who were single and divorced were each 3.3%. One third of participants had no education (30%) while the small proportion of patients had post-secondary education (8.3%). Females were more affected with retinopathy than males (60.8% vs 39.2%). More than half of married participants (53.3%) had diabetic retinopathy while 25% of widowed participants were suffering from retinopathy. Participants with post-secondary education were the least affected by retinopathy (8.3%) while those with no formal education were the subgroup highly affected with retinopathy (30%) (Table 3).

Table 2: Diabetic retinopathy according to eyes.

R	DR Grading	Conditions	
		Right Eye	Left Eye
1	No Apparent DR	183(61.0%)	185(61.70%)
2	Mild NPDR	43(14.30%)	42(14.0%)
3	Moderate NPDR	40(13.30%)	44(14.70%)
4	Severe NPDR	9(3.0%)	8(2.70%)
5	Proliferative DR	7(2.30%)	8(2.70%)
6	Other	18(6.0%)	13(4.30%)

Majority of patients with diabetic retinopathy had diabetes type 2 (92.1%). More than a third of participants (37.5%) with retinopathy lived with DM between 1 and 5 years, while 29.2% lived with DM for from 6 to 10 years. Participants who were on oral hypoglycemic tablets represented 67.5% of the patients with retinopathy while 30% were on insulin injection. Medication adherence was reported by 89.8% of patients with retinopathy and 91.5% without. Similarly, 94.2% of patients with retinopathy and 91.3% of those without knew about the effect of diabetes on the eyes.

The common comorbidity among participant was hypertension. Out of those who reported to have a comorbidity, 106 (83.9%) had hypertension. Kidney diseases were reported by 19.4% participants. All of the comorbid diseases had similar prevalence among patients with and without retinopathy. Nearly four fifth of participants without retinopathy had hypertension while the figure was similar in patients with retinopathy (79.4% vs 83.9%). Comparable figure of comorbid diseases among participants with retinopathy and those without were also reported.

Half of the study participants (50.5%) had HgA1C levels between 7 and 9, and 28.0% participants had HgA1C levels greater than 10%. Similarly, half of participants (47.1%) had cholesterol level more than 200 mg/dl. One fourth of study participants (24.9%) had a triglyceride level of more than 200 mg/dl. Similarly, one fourth of participants (25.6%) had low-density lipoprotein level of more than 160 mg/dl, while high-density lipoprotein below 40 mg/dl was recorded in 80.9% of the participants. More than 27.3% of participants had fasting blood glucose (FBS) level of less than 126 mg/dl. FBS levels of above 200 mg/dl were measured in 25.6% participants (Table 3).

Table 3: Retinopathy according to socio-demographic characteristics.

Variables	Categories	Conditions		
		DR Absent	DR Present	Total
Sex	Male	61(35.3%)	47(39.2%)	108(39.2%)
	Female	112(64.7%)	73(60.8%)	185(60.8%)
	Total	173(100.%)	120(100.%)	293(100.%)
Marital Status	Married	98(56.6%)	64(53.3%)	162(55.3%)
	Living together	23(13.3%)	18(15.%)	41(14.0%)
	Widowed	29(16.8%)	30(25.%)	59(20.1%)
	Separated/Divorced	8(4.6%)	4(3.3%)	12(4.1%)
	Single	15(8.7%)	4(3.3%)	19(6.5%)
	Total	173(100.%)	120(100.%)	293(100.%)
Educational Status	No Education	39(22.5%)	36(30.%)	75(25.6%)
	Primary	39(22.5%)	30(25.%)	69(23.5%)
	Middle	35(20.2%)	32(26.7%)	67(22.9%)
	Secondary	38(22.%)	12(10.%)	50(17.1%)
	Post-secondary	22(12.7%)	10(8.3%)	32(10.9%)
	Total	173(100.%)	120(100.%)	293(100.%)
Type of Diabetic	Type 2	159(91.9%)	111(92.5%)	270(92.1%)
	Type 1	14(8.1%)	9(7.5%)	23(7.8%)
	Total	173(100.%)	120(100.%)	293(100.%)
Years Lived With DM	1-5 Years	128(74.%)	45(37.5%)	173(59.0%)
	6-10 Years	32(18.5%)	35(29.2%)	67(22.8%)
	11-15 Years	7(4.%)	19(15.8%)	26(15.8%)
	Greater than 15	6(3.5%)	21(17.5%)	27(8.8%)
	Total	173(100.%)	120(100.%)	293(100.%)
Medication Modality	Tablet only	139(80.3%)	81(67.5%)	220(75.1%)
	Injection only	25(14.5%)	36(30.0%)	61(20.8%)
	Injection + tablets	1(.6%)	1(.8%)	2(.6%)
	None	8(4.6%)	2(1.7%)	10(3.4%)
	Total	173(100.%)	120(100.%)	293(100.%)

Medication Regularity	Yes	151(91.5%)	106(89.8%)	257(90.8%)
	No	14(8.5%)	12(10.2%)	26(9.1%)
	Total	165(100.%)	118(100.%)	283(100.%)
Reason for Irregularity	Non-compliance	6(42.9%)	3(25.%)	9(34.6%)
	I feel fed up	4(28.6%)	3(25.%)	7(25.%)
	I cannot differentiate	2(14.3%)	0(.%)	2(.%)
	I forget	1(7.1%)	5(41.7%)	6(41.7%)
	Other	1(7.1%)	1(8.3%)	2(8.3%)
	Total	14(100.%)	12(100.%)	26(100.%)
Exercise Frequency	30 minutes/day	111(64.5%)	64(53.3%)	175(59.9%)
	20 minutes/day	25(14.5%)	22(18.3%)	47(16.1%)
	<10 minutes/day	28(16.3%)	31(25.8%)	59(20.2%)
	Other	8(4.7%)	3(2.5%)	11(3.8%)
	Total	172(100.%)	120(100.%)	292(100.%)
Know about DR	Yes	158(91.3%)	113(94.2%)	271(92.5%)
	No	15(8.7%)	7(5.8%)	22(7.5%)
	Total	173(100.%)	120(100.%)	293(100.%)
Comorbidity	Hypertension	54(79.4%)	52(83.9%)	106(66.3%)
	Kidney Disease	16(23.5%)	12(19.4%)	28(17.5%)
	Asthma	8(11.8%)	5(8.1%)	13(8.1%)
	Hepatitis	4(5.9%)	4(6.5%)	8(5.0%)
	Cardiovascular Disease	2(2.9%)	0(.%)	2(1.3%)
	HIV	2(2.9%)	1(1.6%)	3(1.9%)
	Total	68(100.%)	62(100.%)	130(100.%)
Takes Extra Medications	Yes	54(31.2%)	49(40.8%)	103(35.1%)
	No	119(68.8%)	71(59.2%)	190(64.8%)
	Total	173(100.%)	120(100.%)	293(100.%)
HgbA1c	4 to 6	46(26.6%)	17(14.2%)	63(21.5%)
	7 to 9	86(49.7%)	62(51.7%)	148(50.5%)
	>10	41(23.7%)	41(34.2%)	82(28.0%)
	Total	173(100.%)	120(100.%)	293(100.%)
Cholesterol	<200	79(45.7%)	59(49.2%)	138(47.1%)
	200+	94(54.3%)	61(50.8%)	155(52.9%)
	Total	173(100.%)	120(100.%)	293(100.%)
Triglyceride	<200	137(79.2%)	83(69.2%)	220(75.1%)
	200+	36(20.8%)	37(30.8%)	73(24.9%)
	Total	173(100.%)	120(100.%)	293(100.%)
Low Density Lipoprotein	<160	123(71.1%)	95(79.2%)	218(74.4%)
	160+	50(28.9%)	25(20.8%)	75(25.6%)
	Total	173(100.%)	120(100.%)	293(100.%)
High Density Lipoprotein	<40	144(83.2%)	93(77.5%)	237(80.9%)
	40+	29(16.8%)	27(22.5%)	56(19.1%)
	Total	173(100.%)	120(100.%)	293(100.%)
Fasting Blood Glucose	<126	50(28.9%)	30(25.%)	80(27.3%)
	127-180	66(38.2%)	47(39.2%)	113(38.6%)
	181-200	13(7.5%)	12(10.%)	25(8.5%)
	>200	44(25.4%)	31(25.8%)	75(25.6%)
	Total	173(100%)	120(100%)	293(100%)

Factors Associated with Diabetic Retinopathy

Variables that were significant in the bivariate analysis i.e. age, years lived with diabetes, HgbA1c Intake of Additional medication; Triglyceride levels, Low-density lipoprotein levels, and hypertension co-morbidity were entered into the multivariable logistic model.

The result of the multivariable regression showed that age, and years lived with diabetes were significant risk factors for the development of retinopathy. Patients with more than 200 mg/dl triglyceride had 2.37 times odds of developing retinopathy when compared with patients with less than 200 mg/dl. For an increment in a year of lived with diabetes, the odds of developing retinopathy increase by 1.13 times. Compared with subjects who exercise for 30 minutes per day, patients with a daily exercise time of fewer than 10 minutes were at a 2.18 excess risk of being affected by diabetic retinopathy (Table 4).

Discussion

This study assessed the magnitude of diabetic retinopathy and associated factors including socio-demographics, laboratory findings, and medical conditions of patients. Approximately 41% of the study participants had diabetic retinopathy in at least one eye. Congruent results were found in Pakistan (42.86%) [12] and Kenya (41%) [13]. However, much higher DR prevalence was found in Tkur Anbessa Hospital, Ethiopia (51.3%) and Sudan (82.6%) [14,15]. In other

Table 4: Factors associated with diabetic retinopathy.

Variables	Categories	CoR (95% CI)	AoR (95% CI)
Age		1.073(1.048-1.099)***	1.077(1.046-1.108)***
Sex	Female	0.846(0.523-1.369)	
	Male	Ref	Ref
low density Lipoprotein	<160mg/dl	1.44(0.80-2.59)	0.47(0.24-0.94)*
	160+ mg/dl	Ref	Ref
Hypertension	Yes	1.62(0.999-2.64)	1.51(0.42-5.47)
	No	Ref	Ref
Medication Modality	Insulin	5.76(1.13-29.44)*	2.98(0.36-24.35)
	Tablets only	2.33(0.48-11.24)	1.19(0.173-8.23)
	Injection + Tablets	4.0(0.17-95.76)	0.288(0.002-35.08)
	None	Ref	Ref
Exercise Time	20min/day	1.52(0.77-2.92)	1.17(0.52-2.67)
	<10 min/day	1.92(1.06-3.48)*	2.18(1.02-4.65)*
	Other	0.65(0.17-2.54)	0.35(0.057-2.2)
	>30 Min/Day	Ref	Ref
Years lived with DM		1.17(1.11-1.23)***	1.134(1.064-1.209)***
HgbA1c	>10	2.71(1.34-5.47)**	1.601(0.719-3.565)
	7 to 9	1.95(1.02-3.72)*	2.435(1.017-5.827)
	4 to 6	Ref	Ref
Triglyceride	200+ mg/dl	1.69(0.995-2.89)	2.37(1.22-4.59)**
	<200 mg/dl	Ref	Ref
Cholesterol	200+ mg/dl	0.87(0.54-1.38)	
	<200 mg/dl	Ref	
Educational Level	Illiterate	0.83((0.43-1.61)	
	Primary School	0.99(0.512-1.92)	
	Middle School	0.34(0.15-0.75)	
	High School	0.49(0.20-1.18)	
	Post-high school	Ref	
Type of DM	Type 2	0.92(0.38-2.2)	
	Type 1	Ref	
Medication regularity	No	1.22(0.54-2.74)	
	Yes	Ref	
Extra medication	Yes	1.52(0.94-2.47)	
	No	Ref	
Low-density Lipo-protein	160+ mg/dl	0.65(0.374-1.12)	
	<160 mg/dl	Ref	

Note: ***(P<0.05), **(P<0.01), ***(P<0.001)**
R^2 for Multivariable model =0.299(cox & snell), 0.402(negalkerke). Model X^2 (14) =101.10

studies done in Ethiopia and Tamil Nadu India, prevalence rates of 13% and 17.6% were recorded respectively [16,17]. Bistola et al. did a study in Asmara, Eritrea, and found double the prevalence of Diabetic retinopathy in our study (84%) [18]. This difference in the prevalence of retinopathy could be attributed to several factors such as the age, years lived with diabetes, study participants' adherence to medication and lifestyle changes, and/or the research design.

Females represented 60.8% of the total participants, of which 73(60.8%) were affected by retinopathy. Of the 108 male participants, only 41.2% were affected by retinopathy. Similar studies done in Ecuador showed that females represented 66.6% of retinopathy cases with PDR [19] while in a study done in Ethiopia, males were more affected by retinopathy than females (58.3% versus 41.6%) [16]. Reports on the association of sex with retinopathy are different across the literature. No significant association between sex and the occurrence of retinopathy was found in studies done in Ecuador, Arba Minch (Ethiopia), Brazil, Asmara (Eritrea), and Ecuador [16,18-20]. On the contrary, a significant association between sex and retinopathy was reported in research done in Tkur anbessa (Ethiopia) [14].

More than half of the study participants (55%) were married in this study while those who were divorced represented 21% of the study participants. In a study done in India, study participants who were married represented 75.7% of the total participants [21]. Similarly, 72.4% of participants, in a study done in Nigeria were married [22]. There was no significant association between the occurrence of retinopathy and the marital status of the person in the current study.

More than a fifth of the study participants (26%) stated that they have no education. This is much lower than studies done in Karachi (68%) but similar to studies done in Nepal (25%) [23] Of patients with retinopathy, 45% were illiterate or with only primary schooling. Only 23 (7.8%) of the study participants had DM type I while the majority were affected by DM type II. Regarding the years, they lived with retinopathy, 59% of the participants lived with diabetes for periods ranging from 1 to 5 years. In the multivariable analysis, years lived with diabetes showed a significant association with the risk of retinopathy at aOR of 1.13. In a study done in Tkur Anbessa and Arba Minch hospital Ethiopia, the risk of retinopathy increased by 1.13 and 8.84 respectively [14,16]. Similarly, in a study done in Romania, the duration of diabetes

was highly associated with the occurrence of retinopathy [24].

The majority of the study participants (92.5%) reported that they know diabetes cause eye problem. More subjects with retinopathy than those without said, they know about the effect of diabetes on the eye (94.2% versus 91.3%). However, knowledge of the role of diabetic Mellitus in the eyes was not a significant predictor of the occurrence of diabetic retinopathy.

Hypertension was the most common comorbidity cited by 36.1% of the study participants. It was marginally associated with diabetic retinopathy at a p-value of 0.051 in bivariate logistic regression. However, hypertension was an insignificant risk factor in the multivariable logistic regression. There is conflicting finding among different studies about the association of hypertension and diabetic retinopathy. UKPDS study found association of retinopathy with raised systolic pressure, while the CURES study indicated that hypertension did not have a major role in retinopathy [25,26]. In a study done in Thailand, hypertension was an independent risk factor of retinopathy at aOR of 1.80 [27]. In a study done in Ethiopia, a patient who doesn't have hypertension were 31.3% less likely to develop DR compared with patients with hypertension [14].

Of the study participants without retinopathy, 26.6% had optimum HgA1C levels while only 14.2% with retinopathy had a similar figure. Of the patient without retinopathy, 54.3% had elevated total cholesterol levels, and 50.8% of patients with retinopathy were in the same category. Regarding triglyceride findings, more patients without retinopathy than with retinopathy had an optimum reading of triglyceride (79.2% compared with 69.2%). Four fifth of patients with retinopathy (79.2%) had low-density lipoprotein levels below 160 mg/dl and 71.1% of the patient without retinopathy had a similar finding. Of the study participants, 22.5% of those with retinopathy and 16.8% without retinopathy had the optimum level of high-density lipoprotein of more than 40mg/dl. Comparably, more patients without retinopathy (28.9%) had favorable FBS levels of less than 126 mg/dl than patients with retinopathy (25%)

In the bivariate analysis, there was no significant association between the lipid profile and the occurrence of retinopathy. Patients with HgbA1c levels of more than 10mg/dl were 2.71 times more likely to be affected by retinopathy while those with 7-9 mg/dl levels of HgbA1c were at 1.95 times more risk of developing retinopathy. The level of total cholesterol was an insignificant predictor of retinopathy at a p-value of 0.55. similarly, low-density lipoprotein and high-density lipoproteins had insignificant association with the occurrence of retinopathy at a p-value of 0.121 and 0.221 respectively.

In the multivariable model, HgbA1c was an insignificant predictor at a p-value of 0.130. Nonetheless, the association between elevated HgbA1c levels and the occurrence of retinopathy was found in several studies. Xu et al. found an odds ratio of 1.73 per 1% increase in HgbA1c [28] and Romero-Aroca et al. reported 4.01 odds of developing retinopathy for patients with greater than 7 mg/dl of HgbA1c level [29]. Contrary to HgbA1c, LDL was identified to be an independent predictor of retinopathy as those with a lower level of LDL were 53% less likely to be affected by retinopathy. a similar association between LDL and retinopathy incidence was also reported by the Madrid diabetic study [30]. A review done by Xu et al., however, concluded that the evidence for dyslipidemia as a risk factor for DR is inconsistent, as no single lipid measure was found consistently to be associated with the occurrence of DR [28].

Conclusion

This study assessed the prevalence of retinopathy and related factors in Asmara, Eritrea. The prevalence of retinopathy was found to be 41% which is higher than studies done in Ethiopia, India, and Pakistan. Regarding the associated factors of retinopathy: age, years lived with diabetes, Low-density lipoprotein, and triglyceride were found to be independent predictors of diabetic retinopathy. Our finding implies the need for a continuous effort by policymakers and health professionals to tackle factors associated with diabetic retinopathy. Routine health education about the management of diabetes and retinopathy would contribute to reduce the risk of retinopathy among diabetic patients. Further research using a fundas camera is needed to further assess the prevalence and factors that drive retinopathy among the diabetic population in Eritrea.

Abbreviations

NCD=Non communicable disease

DR=Diabetic Retinopathy

SPSS=Statistical Package for Social sciences

NPDR=Non proliferative Diabetic Retinopathy

PDR =proliferative Diabetic retinopathy

DME= Diabetic macular edema

DM=Diabetes Mellitus

LDL=Low Density Lipoprotein

HDL=High Density Lipoprotein

HgA1c=Hemoglobin A1c

UKPDS=UK prospective Diabetes study

CURES=Chennai Urban Rural Epidemiologic study

Ethical Consideration

Ethical approval for the study was sought from the ethical committee of the Ministry of Health, Regional branch office. Before beginning an interview informed consent was obtained from study participants after the aim and procedure of the study were explained. Anonymity and confidentiality of study participants were kept by excluding personal identifiers. Permission from patients or guardians was requested for respondents aged younger than 18.

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Consent for publication

Not applicable

Competing interests

The authors declare that there is no conflict of interest.

Author's contribution

MR, HA, and AB conceived the study. MR, HA, DN, LT, PT, MK,

YH, and, BG collected the data and did the ophthalmic examination. TH and HA did the data Entry. FGM has done the Analysis. MR, HA, and FGM write the manuscript. AB and TM supervised the research and manuscript preparation. All authors read and verified the manuscript.

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