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Abstract

Introduction:
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: [illegible] among diabetic patients was 41%. The mean age of respondents was 57+13.

K[illegible]: Diabetes mellitus; Diabetic retinopathy; Proliferative DR; Non-proliferative DR; HgbA1c

I[illegible]

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. e 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 a er 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

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le 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 le eyes. In general, almost 41 % of the total diabetic patients who participated in the study had DR in either of their eyes (Table 2).

D R S C

Majority of study participants were females (60.8%). e 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

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.%)
		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(173(100.%))Tj12.932 0 Td(120(100.%))Tj11dSpan<</Actua -1.538 T85 -1		

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	[illegible]	[illegible]
Medication Modality	Insulin	1.44(0.80-2.59)	[illegible]
Medication Modality	Insulin		

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]. is di erence 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 a ected by retinopathy. Of the 108 male participants, only 41.2% were a ected 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 a ected by retinopathy than females (58.3% versus 41.6%) [16]. Reports on the association of sex with retinopathy are di erent across the literature. No signi cant 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 signi cant 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]. ere was no signi cant association between the occurrence of retinopathy and the marital status of the person in the current study.

More than a h of the study participants (26%) stated that they have no education. is 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 a ected 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 signi cant 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].

e 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 e ect of diabetes on the eye (94.2% versus 91.3%). However, knowledge of the role of diabetic Mellitus in the eyes was not a signi cant 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 insigni cant risk factor in the multivariable logistic regression. ere is con icting nding among di erent 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 ailand, 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 gure. 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 ndings, more patients without retinopathy than with retinopathy had an optimum reading of triglyceride (79.2% compared with 69.2%). Four h 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 nding. 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 signi cant association between the lipid pro le and the occurrence of retinopathy. Patients with HgbA1c levels of more than 10mg/dl were 2.71 times more likely to be a ected by retinopathy while those with 7-9 mg/dl levels of HgbA1c were at 1.95 times more risk of developing retinopathy. e level of total cholesterol was an insigni cant predictor of retinopathy at a p-value of 0.55. similarly, low-density lipoprotein and high-density lipoproteins had insigni cant association with the occurrence of retinopathy at a p-value of 0.121 and 0.221 respectively.

In the multivariable model, HgbA1c was an insigni cant 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 identi ed to be an independent predictor of retinopathy as those with a lower level of LDL were 53% less likely to be a ected 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].

C

is study assessed the prevalence of retinopathy and related factors in Asmara, Eritrea. e 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 nding implies the need for a continuous e ort 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.

A

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

E

Ethical approval for the study was sought from the ethical committee of the Ministry of Health, Regional branch o ce. Before beginning an interview informed consent was obtained from study participants a er the aim and procedure of the study were explained. Anonymity and con dentiality of study participants were kept by excluding personal identi ers. Permission from patients or guardians was requested for respondents aged younger than 18.

A

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F

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C

Not applicable

C

e authors declare that there is no con ict of interest.

A

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 veri ed the manuscript.

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