

Prevalence of Diabetic Retinopathy and Risk Factors Among Diabetic Patients at University of Gondar Tertiary Eye Care and Training Center, North-West Ethiopia.

Tesfahun Ejigu

University of Gondar

Asmere Tsegaw (✉ asameret@yahoo.com)

University of Gondar

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Abstract

Purpose: Diabetic retinopathy (DR) is one of the most serious complications of diabetes mellitus (DM). It is the most common cause of blindness among the working age group in the developed world and the fifth leading cause of global blindness. In Sub-Saharan Africa, 2.8% of all blindness is caused by DR. Studies addressing the patterns of DR and associated factors are scarce in Ethiopia. The objective of this study was to determine the Prevalence and associated factors of DR among DM patients attending University of Gondar (UOG), Tertiary Eye Care and Training center.

Patients and methods: A cross-sectional study was carried out from March 2019 to February 2020 involving all consecutive diabetes patients who visited the center during the study period. Data were collected using a semi-structured questionnaire and data extraction check list, and entered into SPSS version 20 and analyzed. Univariate and multivariate logistic regression analysis were done to identify predictors of DR. Statistical significance was determined with 95% confidence interval using odds ratio and p-values.

Results: A total of 225 DM patients with mean age of 55.4 ± 13.5 years were studied, of whom 95 (42.2%) had DR. Duration of diabetes ≥ 6 years (AOR= 2.91: 95%CI; 1.01-8.35) and baseline age < 60 years (AOR= 3.2: 95%CI; 1.19 - 8.63) were significantly associated with DR. Diabetic retinopathy was significantly associated with the form of therapy. Those on insulin ($p=0.025$), and oral hypoglycemic agents (OHA) with insulin combination ($p=0.014$) had statistically significantly associated with development of DR. Patients with systolic blood pressure of <140 mmHg were 3.6 times (AOR=0.28:95%CI:0.09-0.82) less likely to have DR. A majority of patients had Non-proliferative DR (NPDR) without diabetic macular edema (DME) (34.2%). DME and proliferative DR (PDR) were seen in 5.7% and 3.6% of the patients respectively. Vision threatening DR (VTDR) was seen in 10.7% of patients. There was significant association between age <60 years and VTDR (AOR=4.19: 95%CI; 1.23-14.35).

Conclusion: The prevalence of DR among our study patients was very high. Longer duration of diabetes, higher systolic blood pressure, baseline age < 60 years, use of insulin alone and use of combination of insulin with OHA were independently associated with DR. Health education; early screening and treatment are recommended.

Introduction

Diabetic retinopathy (DR) is one of the most serious complications of diabetes that impose a great burden on the patient, the health care system and the global economy. It involves damage to the microvasculature of the retina from prolonged exposure to the metabolic changes associated with diabetes.¹

Visual impairment as a result of DR has a significant impact on patients' quality of life, and can compromise their ability to manage their diabetes mellitus successfully, which can in turn have a positive

impact on the incidence of other diabetic complications and negative impact on overall life expectancy and productivity.²

According to estimates from a meta-analysis of published population studies from 1990 to 2012, DR accounted for 2.6% of all blindness and 1.9% of all moderate to severe visual impairment worldwide in 2010. This indicates an increase from 2.1% and 1.3% respectively in 1990.² It was shown that 2.8 % of the blindness in sub-Saharan Africa was caused by DR. ³

Globally, the prevalence of DR among diabetic adults was estimated to be 34.6%. ⁴ The epidemiology of diabetic retinopathy in Africa has also been systematically reviewed. ⁴ In population-based studies, the reported prevalence range in patients with diabetes for diabetic retinopathy was 30.2 to 31.6%, proliferative diabetic retinopathy 0.9 to 1.3%, and any maculopathy 1.2 to 4.5%. In diabetes clinic-based surveys, the reported prevalence range for diabetic retinopathy was 7.0 to 62.4%, proliferative diabetic retinopathy 0 to 6.9%, and any maculopathy 1.2 to 31.1%. ⁴

Few available diabetes clinic based studies in Ethiopia reported prevalence of diabetic retinopathy ranging from 34%-51%. ^{5,6,7,8}

DR is an emerging cause of blindness in the developing world. Identification of the prevalence and associated risk factors of DR in our particular community could indicate areas to focus on in the follow up and care of diabetic patients.

Preservation of sight in DR can be achieved through effective screening, timely laser treatment, intraocular injection of anti-vascular endothelial growth- factor drugs and intraocular surgery. ^{9,10}

Despite the rising prevalence of diabetes and DR, studies addressing the pattern of DR in Ethiopia are scarce. This study was aimed at determining the prevalence and associated determinants of DR among diabetes patients who visited the University of Gondar Tertiary Eye care and Training center Ethiopia.

Patients And Methods

STUDY DESIGN AND PERIOD

A hospital based prospective cross sectional study was carried out from March 2019 to February 2020 at University of Gondar Tertiary Eye Care and Training Center, Ethiopia.

STUDY AREA

The study was conducted at University of Gondar Tertiary Eye Care and Training Center, a major eye care and training center in Ethiopia. It is an ophthalmic referral center for an estimated 14 million people living in North-West Ethiopia. The center provides eye care services both at the base hospital and rural outreach sites and annually, over 80,000 patients are seen at both sites. The base hospital has 8 out-patient clinics, facilities for in-patient care with 30 beds and five operation theatres. Currently, the center has 10

ophthalmologists, five of them with subspecialty training in glaucoma, vitreoretina, cornea and external eye diseases, and ophthalmic plastic and reconstructive surgery. There are also 26 ophthalmology residents, 21 optometrists, 5 ophthalmic officers, and 29 general clinical nurses actively working in the outpatient clinics and operation theatres of the tertiary eye care and training center.

STUDY POPULATION

All consecutive diabetic patients who attended UOG Tertiary Eye care and Training Center retina subspecialty clinic in the study period, who fulfilled the inclusion criteria were studied.

INCLUSION CRITERIA

All medically diagnosed diabetic patients of any age who visited the University of Gondar Tertiary eye care center and gave consent to be included in the study.

EXCLUSION CRITERIA

Diabetic patients with opaque ocular media due to corneal abnormalities or cataract obscuring adequate visualization of the posterior segment of the eye were excluded.

SAMPLE SIZE AND SAMPLING PROCEDURE

All consecutive diabetic patients who visited UOG comprehensive specialized referral hospital tertiary eye care and training center in the specified study period and who fulfilled the inclusion criteria were enrolled into the study.

OPERATIONAL DEFINITIONS

Type 1 DM: Diabetes diagnosed before 30 years of age and whose initial treatment is Insulin.⁹

Type 2 DM: Diabetes diagnosed after 30 years of age and whose initial treatment doesn't include Insulin.⁹

WHO definitions of hypertension¹⁰

Pre Hypertension: Systolic BP = 120mmhg-139mmhg and/or Diastolic BP = 80mmhg-89mmhg

Stage 1 hypertension systolic BP= 140mmhg-159mmhg and/or diastolic BP=90mmhg-99mmhg

Stage 2 Hypertension systolic BP \geq 160mmhg and/or diastolic BP \geq 100mmhg

Vision Threatening Diabetic Retinopathy (VTDR): Severe NPDR, PDR or diabetic macular edema

Body Mass Index, BMI, WHO classification (kg/m²)¹¹

< 18.5=Underweight

18.5 - 24.9= Normal

25 - 29.9= Overweight

≥ 30= Obese

DATA COLLECTION PROCEDURE AND QUALITY CONTROL

Semi-structured interviewer-administered questionnaire, document review and ocular examination were used to collect data. The questionnaire consisted of three sections: Socio-demographic variables (nine items), medical history (nine items) and checklist for clinical and laboratory data extraction (five items). Data quality was ensured through pre-testing the questionnaire before the actual data collection period.

Socio-demographic data and relevant medical history was filled into the pretested semi-structured questionnaire. Laboratory test results of fasting blood Glucose (FBG) and lipid profile were obtained in which a single record of recent FBG level was taken. Blood pressure was measured in sitting position after 5-10 minutes of rest. Hypertension is defined as systolic BP of ≥ 140 mmHg and/or diastolic BP of ≥ 90 mmHg.¹⁰ Body mass index (BMI) was calculated from weight in kilograms and height in meters squared and categorized according to WHO classification.¹¹ Presenting Visual acuity was taken using Tumbling E snellen visual acuity chart and patient sitting at 6 meters position, and classified according to WHO grading of visual acuity¹² as follows. visual acuity better or equal to 6/18 – normal; visual acuity less than or equal to 6/24 and better than or equal to 6/60 – moderate visual impairment; visual acuity less than 6/60 and better than or equal to counting fingers at 3m – severe visual impairment; visual acuity less than counting fingers at 3m – blindness; the results for the eye with better visual acuity was recorded.

Anterior and posterior segment examinations were done using slit lamp bio-microscope and 90D condensing lens was used for detailed evaluation of the retina after dilating the pupil with 1% tropicamide. Grading of the retinal changes was made using the Diabetic Retinopathy Study guidelines¹³ and recorded in six categories: mild, moderate, and severe non-proliferative retinopathy and early, high risk, and advanced proliferative retinopathy. Diabetic macular edema was diagnosed when there were hard exudates on the macula and/or macular thickening obvious on slit-lamp examination and clinically significant macular edema (CSME) was diagnosed based on ETDRS study criteria. In case of asymmetric involvement of eyes, the eye with the most severe diabetic retinopathy grade was taken. In patients with concomitant central or branch retinal vein occlusion, the diabetic retinopathy grade in the eye not involved in the vein occlusion was used. All data were collected and recorded by an ophthalmologist and all diagnoses were confirmed by a retina specialist at the retina clinic of the study center.

DATA PROCESSING AND ANALYSIS

The collected data was checked for accuracy and consistency and manual data clean up and correction of any errors was done. Data was coded and entered into epi-info version 7 and exported to statistical

package for social sciences (SPSS) version 20 for analysis. The Dependent variables were Diabetic retinopathy and Vision threatening diabetic retinopathy and the Independent variables were: Age, Sex, Residency, Type of DM (type 1 or type 2), Duration of DM, Blood pressure, Body Mass Index (BMI), Fasting blood sugar level, Lipid profile, Form of DM therapy.

Descriptive statistics were performed to describe the study population in relation to relevant variables. A univariate logistic regression analysis was done to select the variables to be entered into the final multivariable logistic regression analysis. Explanatory variables (with P-value<0.2) were entered into the final multivariate logistic regression model based on the likelihood ratio. Then, association between the independent variables and the outcome variable was assessed using AOR and 95% CI for the AOR and P-value less than 0.05 as cut-off point for statistical significance. Results were described in terms of numbers, percentages, means and medians, and displayed on tables and bar graphs.

ETHICAL CONSIDERATIONS

Ethical clearance was obtained from UOG ethical review board. Witten informed consent was obtained from the study participants after clear explanation concerning the purpose and importance of the study. The identity of the patient was not exposed in any way and confidentiality of patient record was respected.

Results

A total of 225 diabetic patients were enrolled into the study. There were 135 (60%) males and 90 (40%) females. The mean age was 55.4 ± 13.5 years (Range 16 - 85 years). A majority of patients 160(71.1%) were 50 years old and above and most of the participants 191 (84.9%) came from urban areas.(Table-I) Type 2 DM was the diagnosis in 199 (88.4%) patients and the remaining 26 (11.6%) had type 1 DM. The mean and median duration of diabetes were 8.18 years and 7 years respectively (Ranges from less than one year to 31 years). One hundred fifty six (69.3%) had diabetes for 10 years or less and only 5(2.2%) had diabetes for more than 20 years. (Figure-I)

Regarding treatment modality for diabetes, 135 (60%) were on oral hypoglycemic agents alone, 60 (26.7%) were using insulin alone, 25 (11.1%) were taking oral hypoglycemic agents in combination with insulin injection and 5 (2.2%) patients were on dietary management alone.

Patients were inquired for the presence of any associated systemic condition and hypertension was the most frequent concomitant illness present in 100 (44.4%) of them followed by dyslipidemia in 42(18.7%), kidney disease 7(3.1%), heart disease 3 (1.3%) and others in 8 (3.6%).

The number of patients with prior eye examination for DM related eye disease were 144 (64%) and 39 (17.3%) patients had previous cataract surgery done on one or both eyes. A majority of the patients (57.3%) reported visual reduction as their main ocular complaint. Moderate and severe visual impairment was seen in 34(15.1%) patients and 8 (3.6%) patients were blind. (Table-2)

Diabetic retinopathy was diagnosed in 95 (42.2%) of DM patients of which 62 (65.2%) were male patients and 32 (36.8%) female patients. (Table-6) A greater percentage of patients in the age categories below 60 years had diabetic retinopathy. The mean age in patients with diabetic retinopathy was 53.23 ± 13 which is lower than those without diabetic retinopathy (57.11 ± 13.67). (Figure-2)

There was no statistically significant difference in the prevalence of diabetic retinopathy between patients from urban and rural settings ($p= 0.61$). More percentage of patients with type 1 DM had diabetic retinopathy (46.2%) as compared to type 2 DM patients (41.7%) but there was no statistically significant relationship between the type of diabetes and development of diabetic retinopathy ($P=0.67$).

Patients with disease duration of 6 years and more were more likely to develop diabetic retinopathy than those with disease duration of less than 6 years and the difference being was statistically significant ($P=0.047$). (Table-8)

When the study subjects were categorized based on the form of therapy for diabetes and the status of their eyes, 47 (34.8%) of the OHA group, 33 (55%) of Insulin group and 15 (60%) of the OHA Insulin combination group were diagnosed to have diabetic retinopathy. (Figure-3)

Diabetic retinopathy was significantly associated with the form of therapy. Those on insulin ($p=0.025$), and OHA with insulin combination ($p=0.014$) groups had statistically significantly associated with development of DR. (Table-8)

The mean systolic and diastolic blood pressures of the study population were 128.9 ± 14.5 mmHg and 79.17 ± 8.2 mmHg respectively. There was significant association between systolic hypertension and development of diabetic retinopathy ($p=0.02$). (Table-3) and (Table-8)

More than one third of the patients (39.5%) were overweight or obese and 56.9% had normal body mass index (BMI). Thirty eight (40%) of patients with diabetic retinopathy and 51 (39.3%) of patients without diabetic retinopathy were found to be overweight or obese. There was no statistically significant association between BMI and diabetic retinopathy ($p=0.9$). (Table-3)

The mean fasting blood glucose (FBG) level of the respondents was 157.68 ± 64.5 and only 79 (35.1%) had their FBG below 126 mg/dl. The mean total cholesterol and triglycerides determined for about half of the respondents were 178.1 ± 59.2 and 173.83 ± 82 respectively. (Table-4)

Cataract was the most common concomitant ocular condition present in 112 (49.8%) of the patients. There were 2 patients with monocular vision loss from Central retinal vein occlusion and 9 patients with glaucoma. (Table-5)

The majority of patients with diabetic retinopathy had NPDR without diabetic macular edema (34.2%) and NPDR with macular edema was seen in 4.4%. Diabetic macular edema was identified in 13 patients (5.7%) of whom 6 (2.7%) had CSME. The number of patients with PDR was 8 (3.5%), of whom 6 (2.7%) had high risk PDR. (Table-6)

Vision threatening diabetic retinopathy was seen in 24 (10.7%) of the studied patients. There was significant association between age of patients <60 years and VTDR ($p=0.022$). More percentage of Patients with type 1 DM (41.7%) developed VTDR compared to patients with type 2 DM (22.9%) but there was no significant association between the type of DM and development of VTDR, ($P=0.251$). (Table-7)

A univariate logistic regression was done for every explanatory variable to include into the final multivariable logistic regression model. Then variables with p-value of less than 0.2 in the univariate logistic regression were included into the final model and association of the explanatory variables with diabetic retinopathy and vision threatening diabetic retinopathy was assessed.

Marital status, educational status, occupation, residence, monthly income, type of DM, BMI and FBG level showed no association with diabetic retinopathy ($p\geq 0.2$) on univariate logistic regression analysis and were not included into the final multivariable logistic regression analysis.

Multivariable logistic regression analysis was done for factors with pre-set p-value cut point of <0.2 on univariate logistic regression, it showed that baseline age, duration of diabetes, modality of treatment with insulin or combination of OHA with Insulin and systolic blood pressure were significantly associated with diabetic retinopathy. (Table-8)

Patients with baseline age of <60 years were three times ($AOR=3.2; 95\%CI: 1.19-8.63$) more likely to develop diabetic retinopathy. The odds of diabetic retinopathy is about 3 times ($AOR=2.91; 95\%CI: 1.01-8.35$) higher for patients with disease duration of ≥ 6 years as compared to disease duration of <6 years. Those patients who were not on insulin alone as treatment modality were about 68% less likely ($AOR=0.32; 95\%CI: 0.12-0.86$) to have diabetic retinopathy and diabetic patients who were not on combined insulin and OHA therapy for DM are 80% less likely ($AOR=0.2; 95\%CI: 0.05-0.8$) to have diabetic retinopathy. Systolic blood pressure also had statistically significant association with patients having blood pressure of <140 mmHg being about 3.6 times ($AOR=0.28; 95\%CI: 0.09-0.82$) less likely to have diabetic retinopathy as compared to hypertensive patients with systolic blood pressure of ≥ 140 mmHg. The other cofactors, history of hypertension and total cholesterol level, were not independent significant factors for development of diabetic retinopathy in our study. (Table-8)

Discussion

The prevalence of diabetic retinopathy in this study was 42.2% which is higher than most of the results of previous studies done in Ethiopia and other African countries.^{5,6,8,14-18} The high prevalence seen in our study could be due to the fact that the sample population was taken from a retina subspecialty clinic where most of the patients were referred from the medical diabetic clinic for visual complaints unlike the studies mentioned above which were done at medical diabetic clinics. Different sampling techniques, sample size and diagnostic method may have also contributed to this difference. The very low prevalence (13%) seen in the Arbaminch General Hospital study in Ethiopia by Chisha Y et.al may be due to the fact

that a majority of patients had a diabetes duration below 6 years and age less than 60 years as well as the retrospective record review design of the study.¹⁷

The prevalence in the current study was also higher than the findings from New Zealand, Spain and USA where rates of 22.5%, 14.9% and 14.7% were reported respectively.^{18,19,20} This difference could be due to the very large sample size in those studies, the difference in economic status between Ethiopia and the countries in which those studies were conducted affecting patient care.⁸

However, the finding in our study is lower than the prevalence reported by Shibiru T et.al (51.3%) from Tikur Anbessa Hospital in Ethiopia.⁷ The variations in sample size and diagnostic method may have caused this discrepancy. Some studies from other parts of the world also reported figures higher than the prevalence seen in the current study.²¹⁻²⁴ Many factors may have contributed to this difference including variations in sampling techniques, sample size, study setting, methods of screening, level of awareness among study participants, level of glycemic control and diabetic patient care.

A majority of the study population was constituted by type 2 DM patients (88.4%) in this study, a trend similar to studies done at Tikur Anbessa hospital Ethiopia,⁵ Jimma University hospital Ethiopia⁶ and Arbaminch General hospital Ethiopia¹⁰ where type 2 DM constituted 53.6%, 72.8% and 74.1% of the study subjects respectively.

The prevalence of diabetic retinopathy in type 1 DM patients (46.2%) was slightly higher than the prevalence among type 2 DM patients (41.7%) but the difference was not statistically significant. This is in line with the findings reported from Cameroon, Zimbabwe and Kenya where no significant difference was noted in the prevalence of diabetic retinopathy between the two groups.^{15,16,21}

Although there was no statistically significant difference between males and females in the prevalence of diabetic retinopathy, the prevalence was higher in males (46.7%) compared to females (35.6%). Similar finding was seen in the study done in Cameroon by Njikam E.J et.al in 2011 where the prevalence of diabetic retinopathy in males and females were found to be 54.2% and 46.3% respectively, with no statistically significant association between diabetic retinopathy and gender.²¹ This was in contrast to the report from Kenya by Mariangela W.N in 2011 where prevalence of 19.7% and 37.4% were reported in males and females respectively, and showed significant association of diabetic retinopathy with female gender.¹⁶ This difference might be partly due to the large number of female patients in the later study.

Longer duration of diabetes was significantly associated with the occurrence of diabetic retinopathy in this study and patients with disease duration of 6 years or more were more likely to develop diabetic retinopathy (AOR= 2.91: 95% CI; 1.01 - 8.35) as compared to those with disease duration of less than 6 years. This finding was consistent with major global meta-analyses and most of the studies done in other African countries.^{14-16,21,25-27}

The mean age of diabetes patients in this study was 55.4(±13.5) years which was higher than studies done in Ethiopia^{5,6} and similar to studies done in other parts of the world.^{14-16,21,26,27} However, the mean age of patients with DR (53.23 ± 13 years) was lower than those without DR (57.11 ± 13.67 years) in our study. Patients who were <60 years of age constituted 56% of the participants and they were more affected by diabetic retinopathy than those ≥ 60 years of age with statistically significant difference (AOR= 3.2: 95%CI; 1.19 - 8.63) contrary to many of the other studies that showed advanced age was associated with diabetic retinopathy.^{5,6,17,18,19,22}

There was correlation of diabetic retinopathy with the form of therapy in this study, and diabetic patients who were on insulin alone or combined Insulin and OHA therapy had higher prevalence of diabetic retinopathy. This was in contrast to the report in Cameroon (2011) which showed higher prevalence in those on OHA therapy.⁵ With increasing duration of diabetes and advancing age, patients with type 2 DM may be unable to control their blood sugar level with OHA only and these patients often start insulin alone or combination of insulin and OHA therapy to improve glycemic control. This Poor glycemic control may have contributed for the high prevalence of diabetic retinopathy in the group of patients who were on insulin alone or combination of insulin and OHA therapy in our study.

Poor glycemic control is a risk factor for the development and progression of diabetic retinopathy and is associated with higher prevalence of diabetic retinopathy as shown by reports from different studies. Due to unavailability of HbA1c test, which is the best indicator of the level of glycemic control in the few months preceding the test, fasting blood Glucose (FBG) level at the time of data collection was used to assess the level of glycemic control in our study.

Only 35.1% of study patients had their FBG level below 126 mg/dl and the overall mean FBG level was 157.68 ± 64.5 mg/dl. Diabetic patients with diabetic retinopathy had slightly higher mean FBG level (160.86 ± 70.6 mg/dl) than those who had no diabetic retinopathy (155.35 ± 59.9 mg/dl) but there was no significant association between FBG level and diabetic retinopathy. This was contrary to the finding reported by Sharew G et.al in Jimma university hospital Ethiopia (2009) which showed that FBG level was significantly associated with diabetic retinopathy.⁹ This may be due to the fact that patients with diabetic retinopathy in the Jimma university hospital study had poor glycemic control with relatively much higher FBG level than those without diabetic retinopathy at presentation compared to the findings in our study. Association of poor glycemic control with diabetic retinopathy was also shown by studies done in other parts of the world.^{21,28-31} This difference in the findings between our study and other studies may have resulted from the use of HbA1c to assess level of glycemic control in the studies mentioned.

The mean systolic blood pressure of patients with diabetic retinopathy in this study was 130.56 ± 15.7mmHg which is slightly higher than that of patients without diabetic retinopathy (127.73 ± 13.4 mmHg). It is well established that systemic hypertension affects development and progression of diabetic retinopathy in patients with diabetes. Our study showed significant relationship between systolic blood pressure ≥ 140 mmHg and the occurrence of diabetic retinopathy. This correlates well with research findings from other settings in Ethiopia^{5,6,7,17} as well as elsewhere.^{21,26,27}

Majority of patients with retinopathy had NPDR (38.6%) which was similar to figures reported from Tikur Anbessa Hospital, Ethiopia (36.1%) and Jimma University Hospital, Ethiopia (38.9%) but higher than those reported from Kenya (25.7%) by Dr. Mariangela W.N and Nigeria (24%) by Lawan A et.al. Diabetic macular edema was seen in 13(5.7%) patients of whom 6 (2.7%) had CSME which is lower than Jimma University Hospital study in Ethiopia, (5.5%), the 2011 Kenyatta National Hospital study (4.2%) and 2011 Yaoundé Central Hospital study (8.1%). The prevalence of PDR in this study was 3.6% which is higher than those reported from studies done in Ethiopia ^{5,6} but lower than those reported from other African countries, 5.9% in Kenya (2011), 3.7% in Nigeria (2009) and 14.3% in Cameroon (2011).

Vision threatening diabetic retinopathy was seen in 24 (10.7%) patients which is comparable with results from Zimbabwe (11.4%), Kenya (11.9%), and Uganda (14.6%) among studies done in Africa. ^{15,16,32} Slightly higher findings were reported by Sultan S et.al ³³ and Al-Rubeaan K et.al ³⁴ which showed VTDR in 17.6% and 16.3% respectively. The prevalence of VTDR in our study was also lower than that was seen in Cameroon (27.3%) which may be due to the high prevalence of diabetic retinopathy and associated poor glycemic control in the Cameroon study. ⁵ Some studies reported lower prevalence of VTDR than ours. ^{6,35-39} This discrepancy could be a result of variations in sample size, sampling techniques and studies setting as most of these studies were population based.

One of the limitations of our study is the relatively modest sample size but similar studies done in African health care settings rarely have larger sample size. Another limitation is our inability to determine HbA1C level due to unavailability of the test at the study center. As a result we took only a single measurement of Fasting Blood Glucose level to assess the level of glycemic control in our patients and that is not the idea way of measuring the glycemic status of patients.

Conclusion

The prevalence of diabetic retinopathy and VTDR at UOG referral hospital, tertiary eye care and training center was high. Longer duration of diabetes, being on insulin alone or combination of insulin and OHA and systolic hypertension were independently associated with the presence of diabetic retinopathy. Only about two-third of diabetic patients had prior eye examination in relation to their illness. There was poor glycemic control with only one-third of diabetic patients having their FBG level below the recommended level. Patients with diabetic retinopathy had higher mean FBG level compared to those without retinopathy.

Recommendation

The high prevalence of diabetic retinopathy and VTDR in our study implies the need to improve routine patient care including treatment facility. Continuous effort is required from health care professionals in counseling diabetic patients about the role of blood sugar level and hypertension control in reducing the risk of onset and progression of diabetic retinopathy. Health education for diabetic patients about the

need to have regular eye evaluation for early detection and management of diabetes related eye complications is recommended.

Declarations

Competing Interest:

Authors declare that there is no competing interest in this work

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Tables

Table 1. Socio-demographic characteristics of Diabetic patients presented to UOG, Tertiary Eye care and Training Center North West Ethiopia, (N=225)

Socio-demographic Characteristic	Category	Number	percent
Sex	male	135	60.0
	female	90	40.0
Age(years)	10-19	2	0.9
	20-29	8	3.6
	30-39	19	8.4
	40-49	36	16.0
	50-59	61	27.1
	60-69	65	28.9
	70 and above	34	15.1
Marital status	single	14	6.2
	Married	177	78.7
	Separated	1	0.4
	Divorced	12	5.3
	Widowed	21	9.3
Educational status	Unable to read and write	36	16.0
	Can read and write	31	13.8 16.9 23.6 29.8
	Primary school (grade1-8)	38	
	Secondary school(grade9-12)	53	
	College/University	67	
Occupation	Farmer	17	7.6
	Merchant	31	13.8
	Government/ Private employee	77	34.2
	Unemployed	100	44.4
Residence	urban	191	84.9
	Rural	34	15.1
Average annual income(USD)	<300	26	11.6
	300-700	65	28.9
	700-1500	69	30.7

Table 2. Presenting visual acuity in the better eye of diabetic patients who presented to UOG, Tertiary Eye care and Training Center North West Ethiopia, 2020 (n= 225)

Visual acuity	Number of patients (%)
6/6 – 6/18	183 (81.3)
< 6/18 – 6/60	31 (13.8)
< 6/60 – 3/60	3 (1.3)
< 3/60	8 (3.6)

Table 3. Blood pressure and Body mass index of diabetic patients presented to UOG, Tertiary Eye Care and Training Center, North West Ethiopia, 2020 (n=225)

Variables	
Blood pressure (mmHg)	Mean (SD)
Systolic BP	128.9 (14.5)
Diastolic BP	79.17 (8.2)
Blood pressure classification	Frequency (%)
Normal	94 (41.8)
Pre Hypertensive	68 (30.2)
Hypertensive	63 (28.0)
BMI classification (kg/m ²)	Frequency (%)
< 18.5	8 (3.6)
18.5 - 24.9	128 (56.9)
25 - 29.9	68 (30.2)
≥ 30	21 (9.3)

Table 4. Mean values of selected parameters and diabetic retinopathy at UOG, Tertiary Eye Care and Training Center, North West Ethiopia, 2020

Variable	Diabetic retinopathy	
	Yes	No
Mean (SD)		
BP (mmHg), n=225		
Systolic	130.56±15.7	127.73±13.4
Diastolic	80.86±13.4	79.14±11.2
FBS (mg/dl), n=225	160.86±70.6	155.35±59.9
Total cholesterol (mg/dl), n=113	183.2	175.4
Triglycerides (mg/dl), n=102	161.2	178.5

Table 5. Ocular co-morbidities in patients with diabetes presented to UOG, tertiary eye care and training center North West Ethiopia, 2020 (n=225)

Ocular condition	Number of patients (%)
Cataract	112(49.8)
Glaucoma	9(0.04)
Pathologic myopia	6(0.027)
Hypertensive retinopathy	5(0.02)
Age related macular degeneration	3(0.013)
Central retinal vein occlusion	2(0.01)

Table 6. Types of diabetic retinopathy diagnosed in DM patients presented to UOG, Tertiary Eye care and Training Center, North West Ethiopia, 2020 (n=225)

Variable	NO of patients	Percent
Diabetic retinopathy		
Yes	95	42.2
No	130	57.8
Grade of diabetic retinopathy in the worse eye		
Normal	130	57.8
Mild NPDR	41	18.2
Moderate NPDR	30	13.3
Mild to Moderate NPDR with Non-CSME	5	2.2
Moderate NPDR with CSME	2	0.9
Severe NPDR	6	2.7
Severe NPDR with Non-CSME	1	0.4
Severe NPDR with CSME	2	0.9
Early PDR	1	0.4
High risk PDR	3	1.3
High risk PDR with Non-CSME	1	0.4
High risk PDR with CSME	2	0.9
Advanced PDR	1	0.4

Table 7: Multivariate logistic regression analysis of factors associated with Vision threatening Diabetic retinopathy in patients presented to UOG, tertiary eye care and training center North West Ethiopia, 2020 (n=225)

Variable	VTDR		COR (95%CI)	AOR (95%CI)	P-value
	Yes	No			
	n(%)	n(%)			
Age					
<60	20(15.9)	106(84.1)	4.48(1.48-13.58)	4.19(1.2314.35)	0.022
≥60	4(4.0)	95(96.0)	1.00	1.00	
occupation					
farmer	4 (23.5)	13 (76.5)	4.089(1.05-15.91)	2.69(0.610-11.88)	0.19
merchant	4(12.9)	27(87.1)	1.06(0.297-3.81)	0.72(0.18-2.85)	0.64
gov't employee	4(7.4)	50 (92.6)	1.97(0.536-7.23)	1.697(0.42-6.89)	0.46
private employee	5(21.7)	18(78.3)	3.69(1.05-12.93)	3.86(0.99-15.11)	0.053
unemployed	7(7.0)	93(93.0)	1.00	1.00	
Type of DM					
Type 1	7(26.9)	19(73.1)	3.94(1.45-10.71)	2.19(0.575-8.34)	0.251
Type 2	17(8.5)	182(91.5)	1.00	1.00	
Insulin					
No	11(7.4)	138(92.6)	1.00	1.00	0.86
Yes	13(17.1)	63(82.9)	2.59(1.09-6.096)	1.13(0.302-4.19)	
OHA					
No	12(17.9)	55(82.1)	2.65(1.125-6.26)	1.29(0.325-5.109)	0.718
Yes	12(7.6)	146(92.4)	1.00	1.00	

Hypertension					
No	10(8.0)	115(92.0)	1.00	1.00	0.45
Yes	14(14.0)	86(86.0)	1.87(0.794-4.42)	2.65(1.02-6.87)	
Kidney disease					
No	22(10.1)	196(89.9)	1.00	1.00	0.396
Yes	2(28.6)	5(71.4)	3.56(.65-19.47)	2.339(0.33-16.61)	

Table 8. Multivariate logistic regression analysis of factors associated with diabetic retinopathy in patients presented to UOG tertiary eye care and training center, North West Ethiopia, 2020

Variable	Diabetic retinopathy		COR (95%CI)	AOR (95%CI)	P-value
	Yes	No			
	n(%)	n(%)			
Age					
<60	62(49.2)	64(50.8)	1.94(1.12-3.34)	3.2(1.19-8.63)	0.021
≥60	33(33.3)	66(66.7)	1.00	1.00	
Sex					
Male	62(46.7)	72(53.3)	1.00	1.00	0.527
Female	32(35.6)	58(64.4)	1.586(0.92-2.74)	0.75(0.31-1.83)	
Duration of DM					
<6	27(29.0)	66(71.0)	1.00	1.00	0.047
≥6	68(51.5)	64(48.5)	2.59(1.48-4.56)	2.91(1.01-8.35)	
Insulin					
No	40(52.6)	36(47.4)	1.89(1.09-3.32)	0.323(0.12-0.86)	0.023
Yes	55(36.9)	94(63.1)	1.00	1.00	
Combination					
No	17(65.4)	9(34.6)	2.93(1.24-6.9)	0.2(0.05-0.80)	0.022
Yes	78(39.2)	121(60.8)	1.00	1.00	
Hypertension					
No	51(51.0)	49(49.0)	1.92(1.12-3.28)	0.69(0.26-1.84)	0.458
Yes	44(35.2)	81(64.8)	1.00	1.00	
Systolic BP					
<140 mmHg	60(37.0)	102(63.0)	2.13(1.78-3.84)	0.28(0.09-0.82)	0.02
≥140 mmHg	35(55.6)	28(44.4)	1.00	1.00	
Total cholesterol					
Normal	31(37.3)	52(62.7)	1	1	0.29
Borderline	6(30.0)	14(70.0)	0.72(0.25-2.06)	0.51(0.15-1.72)	
High	10(62.5)	6(37.5)	2.79(0.93-8.45)	1.74(0.45-6.72)	

Figures

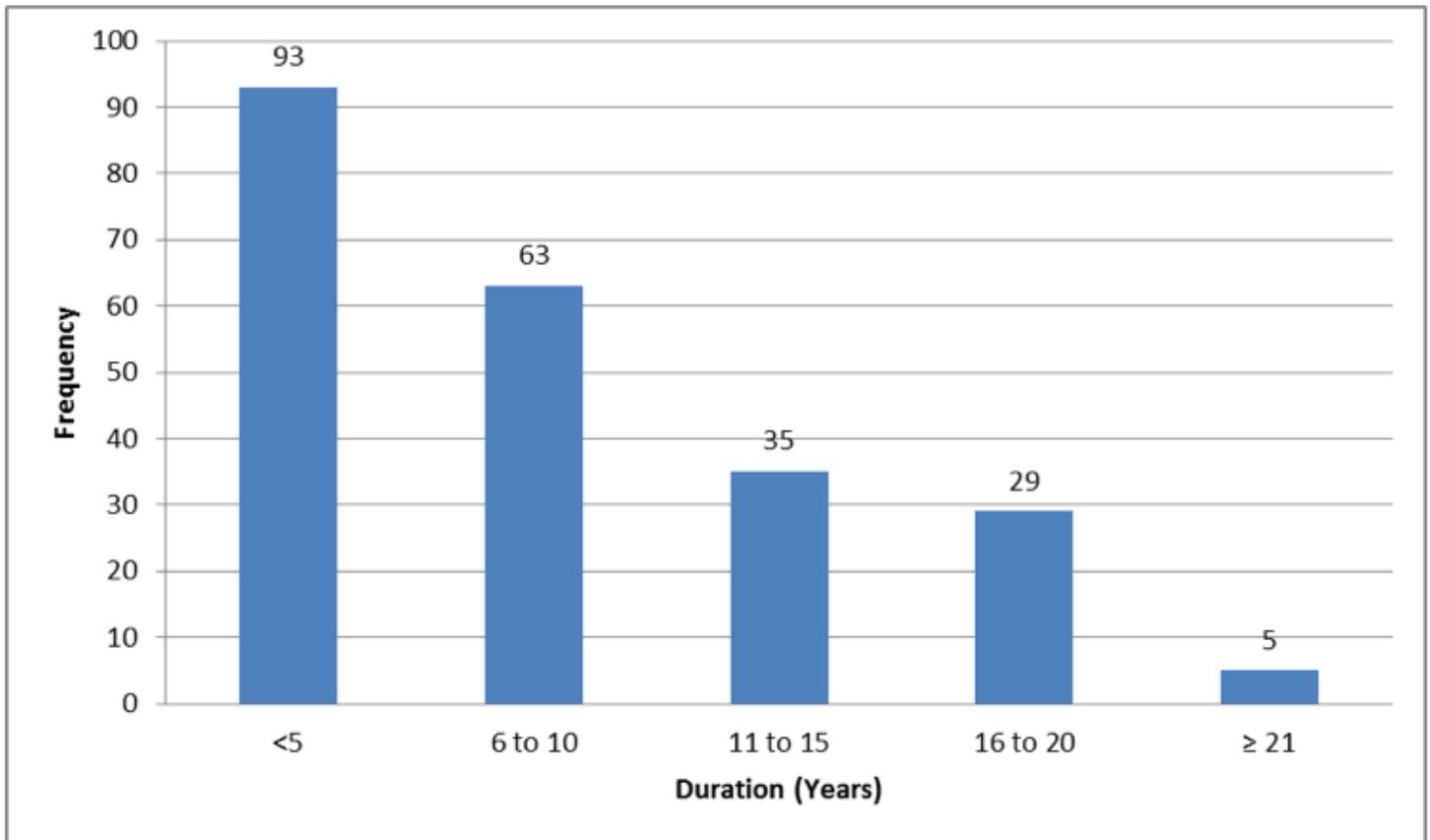


Figure 1

Duration of diabetes of DM patients who presented to the UOG, Tertiary Eye Care and Training Center North West Ethiopia, 2020 (n=225)

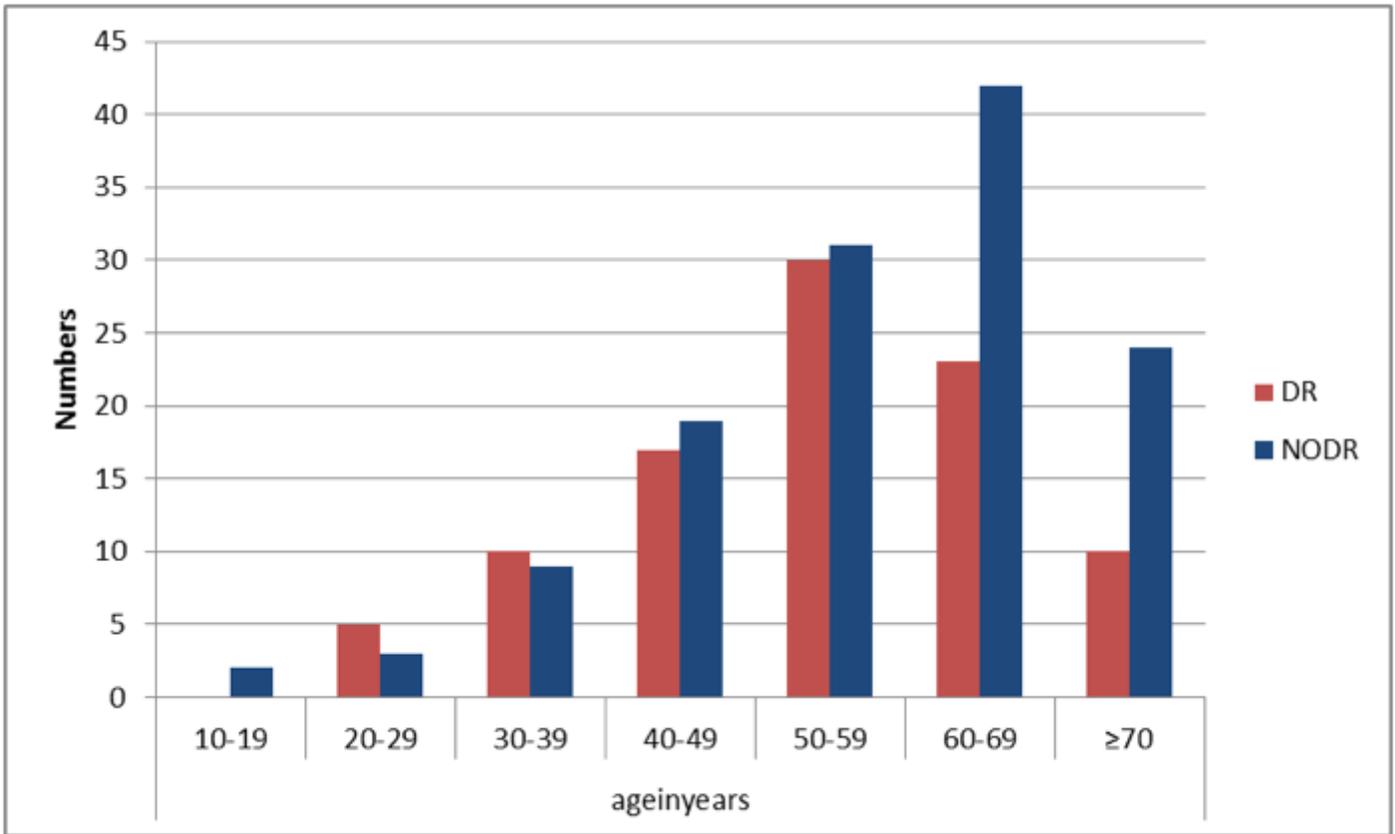


Figure 2

Age distribution of diabetic patients and diabetic retinopathy status at UOG, tertiary eye care and training center, North West Ethiopia, 2020 (n=225)

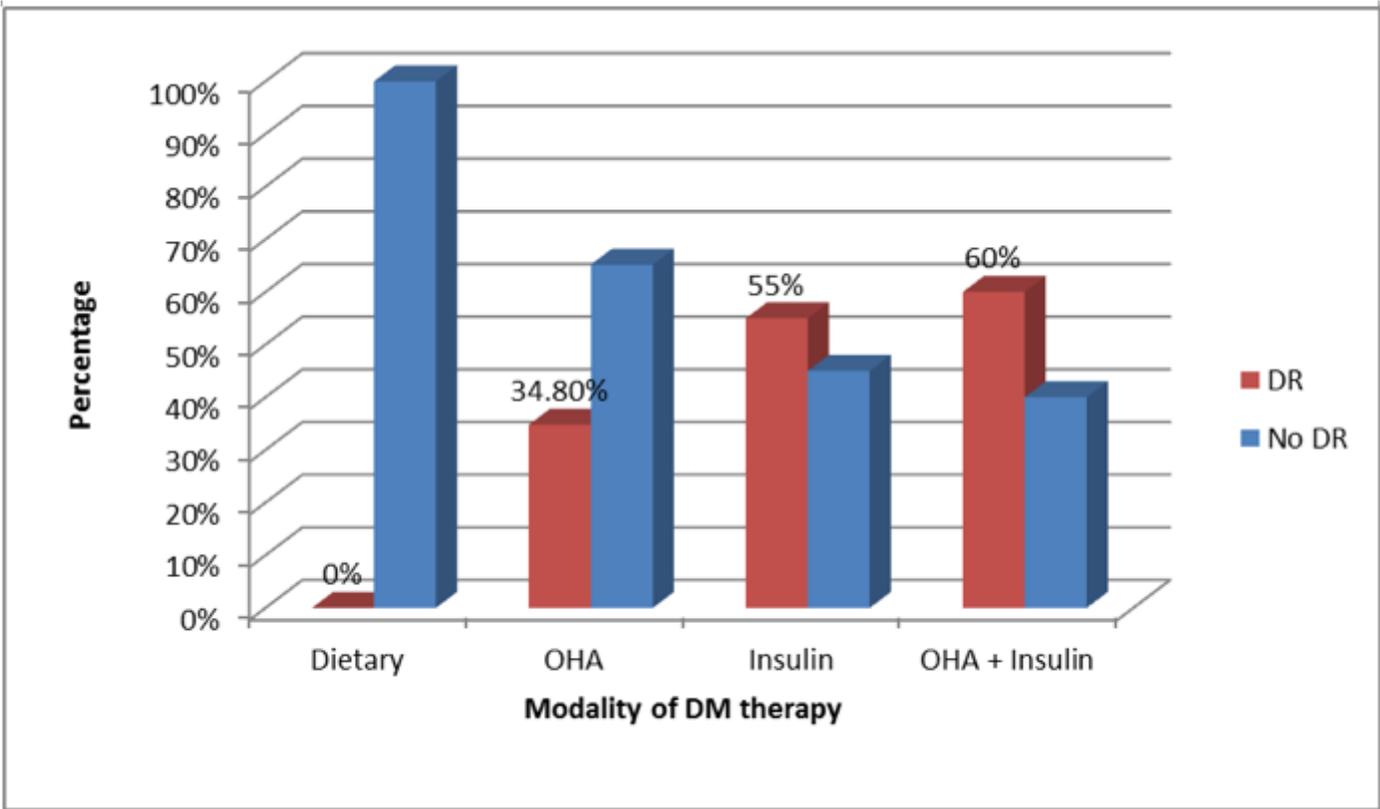


Figure 3

Treatment modalities for DM and prevalence of DR at UOG, Tertiary Eye care and Training Center, North West Ethiopia, 2020 (n=225)