Prevalence of Diabetic Retinopathy and Its Associated Factors Among Diabetic Patients at Debre Markos Referral Hospital, North-west Ethiopia, 2019.

CURRENT STATUS: POSTED

Melkamu Tilahun
Debre Markos University

melkamutilahunalamir@gmail.com Corresponding Author

Teshome Gobena
Jimma University

Diriba Dereje
Jimma University

Mengistu Wolde
Jimma University

Getachew Yideg
Debre Tabor University

10.21203/rs.3.rs-26218/v1

SUBJECT AREAS
Endocrinology & Metabolism

KEYWORDS
Diabetes mellitus; Diabetic retinopathy; associated factor, Ethiopia
Abstract

Background

Diabetic retinopathy is a well-known sight-threatening microvascular complication of diabetes mellitus. Currently 93 million people live with diabetic retinopathy worldwide. There are insufficient studies addressing on the prevalence of diabetic retinopathy and underlying risk factors in Ethiopia.

Objective

To assess prevalence of diabetic retinopathy and its associated factors among diabetic patients on follow up at Debre Markos Referral Hospital, North-West Ethiopia, 2019.

Methods

Institutional based cross-sectional study was conducted among 302 participants at Debre Markos Referral Hospital. They were selected through systematic sampling technique and those with mature cataract and critically ill were excluded. The necessary data were extracted from medical records by using pre-tested checklist. Blood pressure, weight, height and visual acuity tests were assessed. Retinal examination was performed through slit lamp biomicroscope and binocular indirect ophthalmoscope. Data were entered to epi-data 3.1 version. The data were exported into Statistical Package for Social Science (SPSS version 20) program for analyses. Binary logistic regression with 95%CI was used for analyses. A variable had p-value < 0.25 in the bivariable logistic regression was entered to multivariate logistic regression. Finally, variables with p-value < 0.05 in the multivariable logistic regression were considered as statistically significant.

Result

There were 302 participants included in this study, out of which 57(18.9%) had diabetic retinopathy. Among DR patients, three-fourth (75.4%) had pre-proliferative type of diabetic retinopathy. Four in ten (37.7%) of diabetic patients had visual acuity problem. Poor glycaemic control (AOR(95% CI: 4.58(1.86,11.31), having more than 10 years diabetic duration (AOR(95% CI: 3.91(1.86,8.23), body mass index > 25 kg/m2(AOR(95% CI: 3.74(1.83,7.66), and hypertension (AOR(95% CI: 3.39(1.64,7.02) were significantly associated factors with diabetic retinopathy.

Conclusion

About one fifth of DM patients had diabetic retinopathy. Diabetic retinopathy was significantly associated with glycaemic control, hypertension, body mass index and duration of illness. Routine
assessment and early control of those associated factors may be important to reduce both the prevalence and impact of diabetic retinopathy as evidenced in the current study.

Background
Diabetic Retinopathy (DR) is a well-known sight–threatening microvascular complication of diabetes mellitus(1–3). It is characterized by varying degrees of microaneurysm, hemorrhage, hard exudate, cotton wool spot, venous change, and new vessel formation involved in the peripheral, macula, or both part of retina (4–7). Globally, approximately 95 million (35.4%) of diabetic patients had diabetic retinopathy. Out of which one- third had vision-threatening diabetic retinopathy with 7.6% of macular edema (8,9). Global annual incidence of diabetic retinopathy was range from 2.2% to 12.7% and progression was ranging from 3.4% to 12.3 %. The progression to proliferative diabetic retinopathy was higher in individuals with mild disease than in individuals with no disease at baseline (10).

Global prevalence of blindness is estimated to be 1.5 billion out of which 0.4 million is due to diabetic retinopathy. Even though blindness and visual impairment was reduced globally, blindness due to diabetic retinopathy was increased from 0.2 million to 0.4 million and moderate to severe visual impairment was increased from 1.4 million to 2.6 million from 1990 to 2015 respectively (11). However, combination of social, nutritional and medical supports was taken to prevent or stop progress of diabetic retinopathy, still it is a global issue because of epidemic rise of DM and the risk of visual loss is 25 times more in diabetes. Screening and treatment of DR is more challenging in developing countries due to lack of cost and skilled human power (6,8,12). More than $3190 cost lost for screening and treatment of diabetic retinopathy per quality-adjusted life-year-individual. But financial loss due to social and blindness were not estimated (13).

DR is the leading cause of new cases of blindness in middle-aged and elderly population in the Asia-Pacific. It has been estimated the sources of 51% blindness and 56% visual impairment from global prevalence but awareness of DR among diabetic patients ranged from 28% to 84% (14). In Africa, DR was ranged from 7.0 to 62.4% out of which 15% had severe form DR. Ethiopia is one of among the top four countries with the highest (3.8%) adult diabetic population in Sub-Saharan Africa, but still no sufficient studies, screening guidelines, standard referral criteria and retinal photocoagulation
Therefore, the aim of this study was to identified prevalence and determinants of diabetic retinopathy among diabetic patients in the study area.

Methods

Study design, setting and study population

Institution-based cross-sectional study was conducted at Debre Markos Referral Hospital, Debre Markos, Northwest Ethiopia from April 1-30/ 2019. Debre Markos is a town in Amhara region, and found 300 km away from Addis Ababa, the capital city of Ethiopia. All diabetic patients fulfilling the inclusion criteria during the study period were included in this study.

Sample size determination

The required sample size for the study was computed by Epinfo using single population proportion formula with the following assumptions: taking 95% confidence interval (CI), 5% margin of error, and 41.4% proportion (P) of DR which was taken from a study conducted in Jimma University Specialized Hospital (17). In addition, correction formula was applied since the source populations were less than 10,000 and 10% non-response rate was considered. Accordingly, a total of 302 study participants were included in this study.

Sampling technique and procedures

Systematic random sampling method was used to select study participants. Less than three years diabetic follow up for type I diabetes mellitus were excluded. Debre Markos Referral hospital diabetic follow-up clinic provides service from Monday up to Friday every week. There are a total of 2018 DM patients currently attending follow up at Debre Markos Referral Hospital. Every 3rd patients were systematically selected from the sampling frame to get a sample size of 302. Patient’s registry book was used as a sampling frame.

Operational definition

Diabetic retinopathy: On the retinal camera examination the presence of microaneurysm, hemorrhage, exudate, cotton wool spot, intra-retinal microvascular abnormalities, vein beading and/or new blood vessels at least one of the eyes.

Pre-proliferative DR: - On the retinal camera examination the presence of microaneurysm, cotton wool
spot, hemorrhage, vein beading, exudate and/or intra-retinal microvascular abnormalities

Poor glycemic control: - Average of six consequents follow up fast blood sugar greater than 130 mg/dl.

**Data collection technique and procedure**

Data were collected using semi-structured questionnaire, standard stadiometer, digital weight scale, android digital sphygmomanometer, Snellen chart, slit lamp bio microscopy and binocular indirect ophthalmoscope. Blood pressure was measured by using android digital sphygmomanometer through keeping the respondent in a seating position. If a systolic blood pressure is 140 mm Hg or more and/or a diastolic blood pressure is 90 mm Hg or more two consecutive measurements apart from four hours and ongoing treatment with antihypertensive drugs taken as hypertensive respondent. Height was measured with a moveable headboard (stadiometer) and recorded to the nearest 0.1 centimeter. Weight was measured by digital weight scale and recorded to the nearest 0.1 kg (18). Visual acuity test was tested separately at 6 meters in well-illuminated area by using Snellen chart. The participant’s vision was too poor to read any letters on the chart at 6 meters, then counting finger, hand movement and light perception consequently was done (19). Slit lamp biomicroscope (HAAG Streit Bern 90032742, Swiss Made) and binocular indirect ophthalmoscope (HEINE EN53®, Germany) involved for assessment of retina. Dilation of the participants pupil with 1% tropicamide were done before retinal examination. Fine and short beam size with small pinpoint of light was used to good illumination. Anterior segment examination was carried out by using a slit lamp and posterior segment examination was carried out by using a binocular indirect ophthalmoscope (20,21).

**Data quality management**

The questionnaire was translated into local language (Amharic) from its English version then back to English with the guidance of ophthalmologist. Training was provided for the data collectors for one day on how the data should be obtained and recorded. Pre-test was done on 16 DM patients at Fenoteslam General Hospital before the actual data collection time in order to see the validity of the instrument, to estimate the time needed to collect data, and to modify the questionnaire accordingly. Data collectors were supervised while collecting the data by the principal investigator and technical
support was provided accordingly. Data were checked daily for completeness and consistency throughout the data collection period.

**Data processing and analysis**

Completeness and consistency of data collection forms were examined during data management, storage, cleaning and analysis. After data were entered to epi Data 3.1 version, it was exported into Statistical Package of Social Science (SPSS) version 20 for analysis. Data were checked, cleaned, coded, merged, and categorized before analyzed. Continuous variables were expressed in terms of mean ± standard deviation while categorical variables were expressed in proportion. Descriptive statistics and cross tabulation were done for each independent variable. Binary logistic regression with 95% confidence interval was used to assess the association of variables with diabetic retinopathy. A variable had p-value <0.25 in the bivariable logistic regression was entered to multivariate logistic regression. Backward stepwise logistic regression was used for multivariable binary logistic analysis. In the multivariable logistic regression p-value <0.05 was considered as a significant associated variable with diabetic retinopathy. Finally, the results were summarized and presented by text, tables, charts, and graphs.

**Results**

**Socio demographic characteristics of the respondents**

A total of 302 diabetic patients were included in the current study with 99.6% response rate. The respondents mean age was 41.20 (±14.20) years. Two-third (67.5%) of the respondents were males. Half (54%) of the respondents were more than 40 years old. Two-third (65.6%) and three-fourth (76.2%) of respondents were married and urban dwellers respectively. Even though one-third (37.4%) of the respondents had family history of diabetes mellitus, only 5.30 % of them developed diabetic retinopathy. Half (45.0%) of respondents had college education and one-third (35.1%) of respondents were governmental or non-governmental employers (Table 1).

**Behavioral, clinical and diabetic care characteristics of the respondents**

The prevalence of cigarette smoking and alcohol consumption habit of the respondents were 1(0.3%) & 53(17.5%) respectively. Four in ten (37.1%) of the respondents had duration of diabetes greater
than ten years. The mean body mass index was 23.79(±2.6) kg/m². Three-fourth (72.2%) of the respondent’s body mass index were normal and one-fourth (25.8 %) were overweight/obese. One-fourth (23.18%) of respondents had history of hypertension. The mean fast blood glucose level was 131.06 (±26.79) mg/dl and half (50.3%) of the respondents had good glycemic control. More than half (55.6%) of respondents use oral anti-glycemic agents while 43.4% of respondents take insulin for their treatment. About 184 (60.92%) of respondents were visiting health institution every month and one in four (39.08%) were visiting health institution every two months for diabetic follow up (Table 2 & Figure 1).

**Prevalence of Diabetic Retinopathy**

Among three hundred and two participants, 57(18.9%) had diabetic retinopathy. Three-fourth (75.4%) of DR patients had non- proliferative while one-fourth (24.6%) of DR patients had a proliferative type of diabetic retinopathy. Four in ten (37.7%) of the respondents had visual acuity problem and three-fourth (86%) of DR respondents had visual acuity problem (Figure 2).

**Associated factors for Diabetic Retinopathy among DM patients**

In the bivariable logistic regression p-value <0.25 were entered to multivariable logistic regression. Glycemic control, hypertension, BMI and duration of illness had statistically significant association with diabetic retinopathy. The odds ratio developing diabetic retinopathy among those had poor glycemic control were about five times more likely (AOR (95% CI: 4.58 (1.86,11.31) than those having good glycemic control. The odds ratio developing diabetic retinopathy in hypertensive patients were three times (AOR (95% CI: 3.39 (1.64,7.02) more likely chance than non-hypertensive patients. The odds ratio developing diabetic retinopathy among overweight/obese respondents were about four times more likely (AOR (95% CI:3.74 (1.83,7.66) than those having normal bodyweight. The odds ratio developing diabetic retinopathy among patients who had more than ten years diabetic illness were four times more likely risk (AOR (95% CI: 3.91 (1.86,8.23) than those had counterpart (Table 3).

**Discussion**

The finding of the current study showed that, one in five (18.9% (95%Cl (14.5,23.3) of diabetic patients had diabetic retinopathy. This is consistent with studies conducted in Brazil 15% (22), India
21.2% (23) and Mata Analyses in China 18.45% (24). However, it is higher than studies conducted in Beijing 8.1% (25) and Arbamnech General Hospital 13% (26) but lower than studies conducted in Armenia 36.2% (27), Zimbabwe 28.4% (28), Khartoum 82.6% (29) and Jimma in Ethiopia 41.4 % (30). This discrepancy among studies might be due to variation in genetic, methodology, setting, DR risk comorbidities, diagnostic method, quality of care and health seeking behavior among the study participants. In our study, among DR patients three- four (75.4%) had non-proliferative type of diabetic retinopathy. This is lower than study results in India 85.3% (30), Armenia 90.2% (27) but higher than the studies in southern Iran 56.9% (31)and Khartoum 51.7% (29). This variation might be due to quality of care given for diabetic patients and diagnostic method. Four in ten of (37.7%) respondents had visual acuity problem and more than three-fourth (86%) of DR patients had visual acuity problem. This was higher than a study conducted at Nobel Medical College in Biratnagar 24.6% (32). This variation might be due to quality of care given for diabetic patients and life style. In the multivariate logistic regression model glycemic control, hypertension, body mass index, and duration of illness were significantly associated with diabetic retinopathy. In this study, the odds ratio developing diabetic retinopathy among those had poor glycemic control were about five times more likely chance (AOR (95% CI: 4.58 (1.86,11.31) than those having good glycemic control. This result is in line with a systematic review in China (24), Southern Iran (33), Tanzania (34) and Jimma University Hospital(30). The possible mechanism might be poor glycemic control causes vascular cell apoptosis by abnormal glucose metabolism, activation of protein kinase C, formation of advanced glacylation end product, and increased production of reactive oxygen species (35–37).The odds ratio developing diabetic retinopathy among hypertensive patients were three times (AOR (95% CI: 3.39 (1.64,7.02) more likely chance than non-hypertensive patients. This is consistent with studies conducted in Beijing (25), Tanzania (34), Kenya (38), Khartoum (29), Arbamnech General Hospital (26), and Jimma University Hospital (30); but inconsistent with studies conducted in Iran (33). This discrepancy among studies might be due to methodology, confounding effect, variation of self-care practice and variation of hypertensive prevalence among studies. There also exists association between duration of diabetes and diabetic retinopathy in our finding. The odds ratio developing diabetic retinopathy among
patients who had more than ten years diabetic illness were four times more likely risk (AOR (95% CI: 3.91 (1.86,8.23) than those had counterpart. This finding is in line with studies conducted in Armenia (27), Beijing (25), Iran (31), Kenya (38), Tanzania (34), Zimbabwe (28), Khartoum (29), Arbamnech General Hospital (26) and Jimma University Hospital (30).

The odds ratio developing diabetic retinopathy among overweight/obese respondents were about four times more likely chance (AOR (95% CI:3.74 (1.83,7.66) than those having normal bodyweight. This result is in line with the studies conducted in America (39), Iran (31)and Beijing (25); but inconsistent with the studies in Croatia(40), and Minnesota(41).The possible reasons of this discrepancy among studies might be due to methodological differences, differences in study participants, lack of comprehensive anthropometric measurements, and confounding effect; but being overweight/obese causes increasing blood viscosity, oxidative stress, vascular growth factors, leptin, cytokines, and intracellular adhesion molecule-1 which leads to diabetic retinopathy (42,43). Fasting blood sugar was used to assess glycemic control due to the lack of facilities to do HbAlc in the study area was our limitation.

Conclusion
Our result concluded about one fifth (18.9%) of DM patients had diabetic retinopathy. Three-fourth (75.4%) of DR patients had non- proliferative while one-fourth (24.6%) of DR patients had a proliferative type of diabetic retinopathy. Poor glycemic control, hypertension, overweight, obesity, and longer diabetes duration were significantly associated factors with diabetic retinopathy. Ministry of health should establish strategies and polices to control diabetic retinopathy. Health workers also provide sustainable health information to diabetic patients on the possible risk factors to DR (hypertension, overweight/obese, and poor glycemic control) since these are the risk factors for diabetic retinopathy as evidenced the current study.

Abbreviations
AOR: Adjusted Odds Ratio
CI: Confidence Interval
OR: Odds Ratio
DR: Diabetic Retinopathy

Declarations

**Ethics approval and consent to participate**

Ethical clearance and approval were obtained from the Institution Ethical Review Board (IERB) of Jimma University Institute of Health. Explaining the purpose and possible benefit of the study, oral informed consent was obtained from each participant. The study participant was a child, parental written consent was obtained before the data collection. Participants’ confidentiality was ensured. Study participants had right to refuse to join, ask any question or withdraw at any particular time. Respondents who were diagnosed as having retinopathy were linked to the ophthalmic clinic for further management.

**Consent to publish**

Not applicable.

**Availability of data and materials**

We have sent all the available data and we want to share the raw data as we are doing related study.

**Competing interests**

All the authors declare that they have no competing interests.

**Funding**

There was no any funding or sponsoring organization for this study.

**Authors’ contributions**

Melkamu Tilahun wrote the proposal, participated in data collection. Melkamu Tilahun, Diriba Dereje and Teshome Gobena analyzed the data and drafted the paper. Getachew Yideg and Mengistu Wolde approved the proposal with some revisions and participated in data analysis with Melkamu Tilahun and Teshome Gobena. All the authors revised the subsequent drafts of the paper, read and approved the final manuscript.

**Acknowledgements**

The authors would like to thank Debre Markos Referral Hospital administration, Health workers, data collectors. We are also indebted to the study participants for their kind cooperation.
Authors' Information

Melkamu Tilahun\textsuperscript{1*}, Teshome Gobena\textsuperscript{2}, Diriba Dereje\textsuperscript{2}, Mengistu Wolde\textsuperscript{2} Getachew Yideg\textsuperscript{3}

\textsuperscript{1}Department of Medical Physiology, College of Medicine and Health Sciences, Debre Markos University, Ethiopia

\textsuperscript{2}Department of Medical Physiology, School of Medicine and College of Health Sciences, Jimma University, Ethiopia

\textsuperscript{3}Department of Medical Physiology, School of Medicine, College of Health Sciences, Debre Tabur University, Ethiopia

References

1. Paul Lee (Rapporteure) and WHO members. Prevention of blindness from diabetes mellitus. World Heal Organ. 2006;1–48.

2. F. Ghanchi (chair) and authors (CB, UC, JG, GM, PS W. The Royal College of Ophthalmologists Diabetic Retinopathy Guidelines. R Coll Ophthalmol. 2013;2:1–147.

3. Cook L. Kanski ’ s Clinical Ophthalmology. ELSEVER. 2016;8:1–887.

4. Canada D, Practice C, Expert G. Retinopathy Diabetes Canada Clinical Practice Guidelines Expert Committee. Can Diabetes Assoc. 2018;42:210–6.

5. Early Treatment Diabetic Retinopathy Study (ETDRS) Research Group. Grading diabetic retinopathy from stereoscopic color fundus photographsdan extension of the modified Airlie House classification. ETDRS report number 10. Ophthalmology. 1991;98(5):786–806.

6. Stry M, Health OF. Ministry of Health Guidelines for Screening and Management of Diabetic Retinopathyin Kenya. Minist Heal Keneya. 2017;4(2):1–64.

7. Wong TY, Sun J, Kawasaki R, Ruamviboonsuk P, Gupta N, Lansingh VC, et al. Guidelines on Diabetic Eye Care: The International Council of Ophthalmology Recommendations for Screening, Follow-up, Referral, and Treatment Based on
Resource Settings. Ophthalmology [Internet]. 2018;125(10):1608–22. Available from: https://doi.org/10.1016/j.ophtha.2018.04.007

8. N. Hancho (chair), J. Kirigia, J. Claude KO. IDF Diabetes Atlas. International Diabetes Federation. 2017;8:1-150.

9. Lee R, Wong TY, Sabanayagam C. Epidemiology of diabetic retinopathy, diabetic macular edema and related vision loss. Eye Vis [Internet]. 2015;2(1):1-25. Available from: http://dx.doi.org/10.1186/s40662-015-0026-2

10. Sabanayagam C, Riswana Banu D, Chee ML, Ryan Lee M, Wang YX, Gavin Tan, et al. Incidence and progression of diabetic retinopathy: a systematic review. Lancet. 2018;7(2):140-9.

11. Flaxman SR, Bourne RRA, Resnikoff S, Ackland P, Braithwaite T, Cicinelli MV, et al. Global causes of blindness and distance vision impairment 1990 – 2020: a systematic review and meta-analysis. Lancet Glob Heal. 2017;5(12):1221–34.

12. Shu D, Ting W, Ophth M, Chui G, Cheung M. Review Diabetic retinopathy: global prevalence, major risk factors, screening practices and public health challenges: a review. 2016;(July 2015):260-77.

13. Lamoureux EL, Hassell JB, Keeffe JE. The Impact of Diabetic Retinopathy on Participation in Daily Living. ARCH OPHTHALMOl. 2004;122(2):84–8.

14. Chua J, Xin C, Lim Y, Wong TY. Diabetic Retinopathy in the Asia-Pacific. Asia-Pacific J Ophthalmol. 2018;7(1):3-16.

15. R. Gojka (chair), M. Cowan and TA. Global Report on Diabets. World Heal Organ. 2016;3:1-88.

16. Abebe N, Kebede T, Addise D. Review Article Diabetes in Ethiopia 2000-2016 – prevalence and related acute and chronic complications ; a systematic review. African J Diabetes Med. 2017;25(2):7-12.
17. Dell RB, Holleran S, Ramakrishnan R. NIH Public Access. Dell al. 2012;43(4):207-13.

18. American Academy of Pediatrics. Guideline # 4 ANTHROPOMETRIC MEASUREMENTS. marketing@aap.org. 2016;8:1-7.

19. Janet Long, Jillian Grasso. EYE EDUCATION FOR EMERGENCY CLINICIANS EYE. Statew Ophthalmol Serv. 2008;16(3):1-21.

20. Veys J. Slit-lamp Examinatio:Essential Contact Lens Practice. Vis care Inst. 2016;14(2):1-12.

21. Nic Jacobs, MA, COA, CCRC O. Advanced Slit Lamp Skills. Nic.jacobs@chuvision.com. 2001;952(835):1-45.

22. Borges D, Mendanha DA, Martins M, Vilar C. Risk factors and incidence of diabetic retinopathy. Rev Bras Oftalmol. 2016;75(6):443-6.

23. Bharathi N, Kalpana S, Sujatha L, Nawab A, Kumar H. Prevalence of diabetic retinopathy in diabetics of rural population belonging to Ramanagara and Chikkaballapura districts of Karnataka. Int J Sci Res Publ [Internet]. 2015;5(1):2250-3153. Available from: www.ijsrp.org

24. Song P, Yu J, Chan KY. Prevalence, risk factors and burden of diabetic retinopathy in China: a systematic review and meta-analysis. 2018;

25. Cui J, Ren JP, Chen DN, Xin Z, Yuan MX, Xu J, et al. Prevalence and associated factors of diabetic retinopathy in Beijing, China: A cross-sectional study. BMJ Open. 2017;7(8):1-6.

26. Chisha Y, Terefe W, Assefa H, Lakew S. Prevalence and factors associated with diabetic retinopathy among diabetic patients at Arbaminch General Hospital, Ethiopia: Cross sectional study. PLoS One. 2017;12(3):1-9.

27. Giloyan A, Harutyunyan T, Petrosyan V. The prevalence of and major risk factors associated with diabetic retinopathy in Gegharkunik province of Armenia: Cross-
sectional study. BMC Ophthalmol [Internet]. 2015;15(46):1–7. Available from: ???

28. Okwanga PN, Mukona M, Mateveke K, Machingura Pl, Macheka B, Gomo E. Prevalence and risk factors associated with retinopathy in diabetic patients at Parirenyatwa Hospital outpatients’ clinic in Harare, Zimbabwe. Arch Med Biomed Res. 2017;3(2):104.

29. Elwali ES, Almobarak AO, Hassan MA, Mahmood AA, Awadalla H, Ahmed MH. Frequency of diabetic retinopathy and associated risk factors in Khartoum, Sudan: population based study. Int J Ophthalmol. 2017;

30. Sharew G, Ilako DR, Kimani K Gy. Prevalence of diabetic retinopathy in Jimma University Hospital, Southwest Ethiopia. Ethiop Med J. 2013;51(2):105–13.

31. Ghaem H, Daneshi N, Riahi S, Dianatinasab M. The Prevalence and Risk Factors for Diabetic Retinopathy in Shiraz, Southern Iran. Diabetes Metab J [Internet]. 2018;42(August). Available from: https://e-dmj.org/DOIx.php?id=10.4093/dmj.2018.0047

32. Adhikari1*, Bishwa Nath PSG. Journal of Nobel Medical College Prevalence and Associated Risk Factors for Diabetic Retinopathy among in-patients Diagnosed with Diabetes Mellitus : A Retrospective Study Conducted in Nobel Medical College and Teaching Hospital , Biratnagar . J Nobel Med Coll. 2018;7(1):50–5.

33. Hajian-Tilaki SAR *1 K. Associated factors of diabetic retinopathy in patients that referred to teaching hospitals in Babol. Casp J Intern Med. 2015;6(4):224–8.

34. Cleland CR, Burton MJ, Hall C, Hall A, Courtright P, Makupa WU, et al. Diabetic retinopathy in Tanzania: Prevalence and risk factors at entry into a regional screening programme. Trop Med Int Heal. 2016;21(3):417–26.

35. Ola MS, Nawaz MI. Cellular and Molecular Mechanism of Diabetic Retinopathy. INTECH open. 2010;1:1–29.
36. Rask-madsen C, King GL. Review Vascular Complications of Diabetes: Mechanisms of Injury and Protective Factors. CMET. 2012;17(1):20-33.

37. Cahalan MD, Nader N, Hodeify R, Kulkarni RP E-NN. Effects of Hyperglycemia on Vascular Smooth Muscle Ca2+ Signaling and oxidative stress. Biomed Res Int. 2017; (February):1-16.

38. Mathenge W, Bastawrous A, Peto T, Leung I, Yorston D, Foster A, et al. Prevalence and correlates of diabetic retinopathy in a population-based survey of older people in Nakuru, Kenya. Ophthalmic Epidemiol. 2014;21(3):169-77.

39. Dabelea D, Stafford JM, Mayer-Davis EJ, D’Agostino R, Dolan L, Imperatore G, et al. Association of type 1 diabetes vs type 2 diabetes diagnosed during childhood and adolescence with complications during teenage years and young adulthood. JAMA - J Am Med Assoc. 2017;317(8):825-35.

40. Kaštelan S, Tomić M, Gverović Antunica A, Ljubić S, Salopek Rabatić J, Karabatić M. Body mass index: A risk factor for retinopathy in type 2 diabetic patients. Mediators Inflamm. 2013;2013.

41. Ballard DJ, Melton LJ, Dwyer MS, Trautmann JC, Chu CP, O’Fallon WM, et al. Risk factors for diabetic retinopathy: A population-based study in Rochester, Minnesota. Diabetes Care. 1986;9(4):334-42.

42. Silha J V., Krsek M, Sucharda P, Murphy LJ. Angiogenic factors are elevated in overweight and obese individuals. Int J Obes. 2005;29(11):1308-14.

43. Dorchy H, Claes C, Verougstraete C. Risk factors of developing proliferative retinopathy in type 1 diabetic patients: role of BMI. Diabetes Care. 2002;25(4):798-9.

Tables
Table 1: Socio-demographic characteristics of diabetic patients on follow up at Debre Markos Referral
## Variables (N = 302)

| Variables                  | Diabetic Retinopathy | Total number (%) |
|----------------------------|----------------------|------------------|
|                            | Yes                  | No               |
|                            | Number (%)           | Number (%)       |
| Sex                        |                      |                  |
| Female                     | 23 (7.62)            | 75 (24.83)       |
| Male                       | 34 (11.26)           | 170 (56.29)      |
| Age                        |                      |                  |
| ≤40 years                  | 9 (2.98)             | 130 (43.05)      |
| >40 years                  | 48 (15.89)           | 115 (38.08)      |
| Religions                  |                      |                  |
| Orthodox                   | 53 (17.55)           | 226 (74.83)      |
| Muslim                     | 4 (1.32)             | 19 (6.29)        |
| Place of Residency         |                      |                  |
| Rural                      | 8 (2.65)             | 64 (21.19)       |
| Urban                      | 49 (16.23)           | 181 (60.93)      |
| Marital status             |                      |                  |
| Single                     | 1 (0.33)             | 48 (15.89)       |
| Married                    | 31 (10.26)           | 167 (55.30)      |
| Divorced                   | 5 (1.66)             | 11 (3.64)        |
| Widowed                    | 20 (6.62)            | 19 (6.30)        |
| Educational status         |                      |                  |
| No formal education        | 9 (2.98)             | 46 (15.23)       |
| Primary-level education    | 11 (3.64)            | 60 (19.86)       |
| Secondary -level education | 2 (.66)              | 38 (12.58)       |
| College education and above| 35 (11.60)           | 101 (33.41)      |
| Occupation                 |                      |                  |
| Merchant                   | 25 (8.28)            | 83 (27.48)       |
| Employee                   | 24 (7.95)            | 82 (27.15)       |
| Farmer                     | 8 (2.65)             | 49 (16.23)       |
| Student                    | 0 (0)                | 31 (10.26)       |
| Family history of DM       |                      |                  |
| No                         | 41 (13.58)           | 148 (49.01)      |
| Yes                        | 16 (5.30)            | 97 (32.12)       |
Table 2: Behavioral, clinical and diabetic care related characteristics of the respondents at Debre Markos Referral Hospital, North West Ethiopia, 2019

| Variables (N = 302)                      | Diabetic Retinopathy | Total Number (%) |
|-----------------------------------------|----------------------|------------------|
|                                          | Yes                  | No               | Number (%)     |
| Alcohol consumption                      |                      |                  |                |
| Never drink after Dx                     | 43(14.24)            | 206(68.21)       | 249(82.45)     |
| Drinker                                 | 14(4.64)             | 39(12.91)        | 53(17.55)      |
| Duration of DM illness                   |                      |                  |                |
| ≤10 years                               | 14(4.64)             | 176(58.28)       | 190(62.92)     |
| >10 years                               | 43(14.24)            | 69(22.28)        | 112(37.09)     |
| Glycemic control level                  |                      |                  |                |
| Good control                            | 7(2.32)              | 145(48.01)       | 153(50.33)     |
| Poor control                            | 50(16.56)            | 100(33.11)       | 149(49.34)     |
| Hypertension                            |                      |                  |                |
| No                                      | 25(8.28)             | 207(68.54)       | 232(76.82)     |
| Yes                                     | 32(10.60)            | 38(12.58)        | 68(23.18)      |
| Chronic cardiac illness                 |                      |                  |                |
| No                                      | 49(16.22)            | 243(80.46)       | 292(96.70)     |
| Yes                                     | 8(2.65)              | 2(0.66)          | 10(3.30)       |
| Chronic kidney disease                  |                      |                  |                |
| No                                      | 55(18.21)            | 242(80.13)       | 297(98.35)     |
| Yes                                     | 3(0.99)              | 2(0.66)          | 5(1.65)        |
| Treatment Modality                      |                      |                  |                |
| Oral agent alone                        | 41(13.57)            | 127(42.05)       | 168(55.63)     |
| Insulin alone                           | 14(4.64)             | 117(38.74)       | 131(43.38)     |
| Both                                    | 2(0.66)              | 1(0.33)          | 3(0.99)        |
| Follow up frequency                     |                      |                  |                |
| Every month                             | 29(9.60)             | 155(51.32)       | 184(60.92)     |
| Every two months                        | 28(9.26)             | 90(29.80)        | 118(39.07)     |
| Routine DR eye screening                |                      |                  |                |
| No                                      | 31(10.26)            | 220(72.85)       | 251(83.11)     |
| Yes                                     | 26(8.61)             | 25(8.28)         | 51(16.88)      |

Table 3: Multivariable analysis of socio-demographic, clinical and diabetic care and treatment
modality related characteristics of diabetic patients at Debre Markos Referral Hospital, North-West Ethiopia, 2019

| Variables (n = 302) | Retinopathy | COR with 95% CI | AOR with 95% CI |
|---------------------|-------------|----------------|-----------------|
|                     | Yes         | No             |                 |
| Age                 |             |                |                 |
| ≤40 years           | 9           | 130            | 1               |
| >40 years           | 48          | 115            | 6.03 (2.83,12.83) | 1.39(0.532,3.65) |
| Glycemic control level |             |                |                 |
| Good                | 7           | 145            | 1               |
| Poor                | 50          | 100            | 10.35 (4.512,23.77) | 4.58(1.86,11.31) |
| Hypertension        |             |                |                 |
| No                  | 25          | 207            | 1               |
| Yes                 | 32          | 38             | 6.97 (3.72,13.1) | 3.39(1.64,7.02) |
| Body mass index     |             |                |                 |
| BMI 18.5-25kg/m2    | 23          | 195            | 1               |
| BMI >25kg/m2        | 34          | 44             | 6.55 (3.52,12.204) | 3.74(1.83,7.66) |
| BMI < 18.5kg/m2     | 0           | 6              | .000            | .000            |
| Treatment modality  |             |                |                 |
| Oral agent alone    | 41          | 127            | 1               |
| Insulin alone       | 14          | 117            | 0.36 (0.19, 0.69) | 1.306(.51,3.35) |
| Both                | 2           | 1              | 1.5 (0.13,16.97) | 1.52(.10,22.56) |
| Duration of DM      |             |                |                 |
| ≤10 years           | 14          | 176            | 1               |
| > 10 years          | 43          | 69             | 7.83 (4.03,15.2) | 3.91(1.86,8.23) |

(**) Statistically significant at p-value < 0.05

Figures
Figure 1

Percentage of body mass index among DM patients on follow up at Debre Markos Referral Hospital, North-West Ethiopia, 2019
Figure 2

Prevalence of diabetic retinopathy among diabetic patients on follow up at Debre Markos Referral Hospital, North-West Ethiopia, 2019