Original Research Article

Risk Factors Associated with Diabetic Retinopathy Among Patients Aged 50-75 Years Attending Diabetic Clinic At Mbagathi Hospital Nairobi County, Kenya.

Abstract

Background: According to research, nearly 60% of persons with type 1 diabetes are likely to experience diabetes retinopathy after 20 years after the initial diagnosis of diabetes type 1. Nearly 40 % of all persons with unrestrained type 2 diabetes are likely to experience diabetes retinopathy during their lifetime.

Objective: The study aimed to determine the risk factors associated with Diabetes Retinopathy among patients aged between 50 - 75 years seeking care at Mbagathi Hospital Nairobi County, Kenya.

Method: This study used an analytical cross-sectional study design.A systematic random sampling design was used to recruit study partakers.The sample size for this study was 151 study respondents. Both Bivariate and binary logistic regression techniques were also utilized to evaluate the degree of association between the independent and the dependent variable. Statistical significance was set at p=<0.05.

Results: The prevalence of diabetic retinopathy in this study was 31.5% indicating this is a real public health concern that needs an urgent multisectoral approach. From this study, The presence of laboratory services(OR=10,95%CI=3.56-30.99), support group (OR=5.2,95%CI=1.81-14.85), provision of health care message (OR=11.6,95%CI=3.46-38.59), normal BMI (OR=3.6.95%CI=19.88-65.36) reduced the odds of diabetes retinopathy.Drinking alcohol(OR=22,95%CI=0.003-0.771),smoking(OR=33.95%,CI=0.004-0.262), uncontrolled blood sugars(OR=4,95%CI=19.89-65.36) increased the odds of diabetes retinopathy.Low education level(OR=5.9,95%CI=0.03-0.79), earning less than 6000 Ksh per month(OR=9,95%CI=0.04-0.29)smoking(OR=33.3,95%CI=0.004-0.262), uncontrolled blood sugars(OR=4,95%CI=19.89-65.36) increased the odds of diabetes retinopathy.

Conclusion: The prevalence of diabetic retinopathy was high, earning less than 6000 Ksh per month, drinking alcohol, smoking, Low education level, and having uncontrolled blood sugars increased the odds of diabetes retinopathy. The presence of laboratory services, support group, provision of health care messages, and normal BMI reduced the odds of diabetes retinopathy

Keywords:*Diabetic Macular Edema, Diabetes Mellitus, Diabetic Retinopathy,Eye Complications.*

1. INTRODUCTION

The term Diabetes Mellitus(DM) stands for a group of metabolic disorders that are categorized by elevated levels of glucose often known as hyperglycemia in the absence of treatment[1]. Diabetic Mellitus is characterized by inadequate insulin production, poor insulin action, or both this often leads to disruption of fat, protein, and carbohydrate metabolism [2]. The most common long-term effect of diabetes includes diabetes neuropathy, retinopathy, and diabetic nephropathy among other complications[2]. The likelihood of vision loss in an individual with diabetes is up to 25 times more in non-diabetic people. People with poorly controlled diabetes are more likely to develop systemic complications, including retinopathy. Long-term diabetes management is crucial to prevent or delay the advancement of eye complications[3].

There are worrying trends of increased cases of diabetes, recent statistics from WHO there are 435 million cases of diabetes globally with a higher number of the cases being recorded in developing nations[4]. The international diabetes federation approximates that if no measures or interventions are put

in place to curb the problem, it is estimated that by the year 2045, the number of diabetes cases will have increased by 48% in 2045. In recent statistics, the Age-adjusted magnitude in adults with diabetes surged from 4.7% in 1980 to 10.5% by 2019[5].Worldwide, the number of diabetes cases has got to an epidemic level which is worrying. Low and middle-income nations are highly affected by these emerging trends. In a report by the international diabetes federation of 2017, it's estimated there are more than 425 million in the world who have diabetes Mellitus [6]. In Africa, its approximated that 15.9 million adults are currently surviving diabetes which is a regional magnitude of 3.1%[7]. Despite diabetes being a public health concern, Africa has the most undiagnosed diabetes Mellitus cases and according to projected statistics, Africa will encounter the highest future rise in the load of DM of about 156% by 2045[8].

The International Diabetes Federation approximates the magnitude of diabetes Mellitus in Kenya in 2015 to be 2-5%, and over 50% of cases are undiagnosed. Kenya is experiencing a rise in diabetes as a result of demographic, nutritional, and social changes such as urbanization[9]. According to the international diabetes federation, in the year 2015, the prevalence of diabetes in Kenya was at 5% where 50% of these cases were still undiagnosed[10]. Kenya is steadily experiencing a spike in diabetes cases which has been linked to social changes such as urbanization, change in nutrition habits, and change in social demographic factors[11]. As the prevalence rises, patients face an even higher threat from long-term eye complications.

The likelihood of vision loss in a person with diabetes is 25 times higher than in non-diabetic persons. People with poorly controlled diabetes are more likely to develop systemic complications, including retinopathy[12]. Long-term diabetes management is important in delaying the progression of eye complications. Improved lipid profile and hypertension control can also slow the progression of retinopathy, especially when initiated soon after the diagnosis of diabetes[13].Prevention measures for diabetes include dietary modification, the use of medical interventions, regular screening for Diabetes Retinopathy, and adopting a healthy lifestyle[14]. Vision loss from DR can be averted or reduced through adequate control of blood sugar, prompt diagnosis, and treatment of retinopathy. Periodic retinal examinations even when there are no signs and symptoms are key to preventing diabetes-related vision loss.

2. METHODOLOGY

2.1 Research Design

This study used an analytical cross-sectional study design. It involved figuring out how the independent variable (risk factors) and dependent variable (Diabetes retinopathy) were related to one another.

2.2 Study Area

Primary data was collected from the Mbagathi county hospital DM clinic. Mbagathi county hospital is a level five hospital located in Nairobi County, Lang'ata Constituency it serves an urban population mostly from the slum area. The health facility has over 400 patients seeking diabetes care every month[15].

2.3 Study Population

All diabetic patients aged between 50-75 years on follow-up at Mbagathi diabetic clinic presented during the study period. They were considered since they were at high risk of developing diabetic retinopathy as compared to other age groups.

2.4 Sample Size Determination

The sample size was determined using the formula designed by Fisher as recommended by Mugenda and Mugenda (1999).As a result, 137 clients made up the final sample size for this study. Additionally, 10% of the non-respondent rate resulted in 151 study participants overall.The health facility has about 400 a point of diabetic patients every month. To determine the sampling interval the following formula was used.

Sampling interval= 400/151

= **3**

To determine the initial starting point, the first participant was randomly selected.

2.5 Sampling Technique

Mbagathi county hospital was purposively selected, A systematic random sampling design was used to recruit study partakers in this study where all diabetic clients aged 50 to 75 years were carefully selected to participate in the study.

2.6 Data Collection Method and Instruments

A semi-structured questionnaire form was used to capture the data information required in this study. Section A of the questionnaire captured data on patients' factors associated with Diabetes Retinopathy, section B captured data on Diabetes Retinopathy screening, section C captured data on lifestyle factors and lastly, section D captured data on health facility factors associated with Diabetes Retinopathy.

2.7 Validity and Reliability

Validity refers to the correctness of the research instruments which promotes the collection of accurate data and information. An expert was requested to appraise the data-gathering tools, and supervisors and a diabetologist was requested to review the data-gathering tools before embarking on the data-collection process.The degree to which data collection is reliable provides the same finding after being subjected to the study participants than ones. Carefully selected study participants were used to carry out the reliability of the study tools. Cronbach alpha reliability test was carried out using SPSS version 26, literature accepts an internal consistency of above 0.7. According to the findings of the reliability test, a score of 0.94 was obtained, which confirmed that the tools were reliable for data collection.

2.8 Data Processing and Analysis

Using Microsoft Excel, the collected data was cross-checked and verified for accuracy and completeness to prevent double entry before being entered into the Statistical Package for Social Sciences (SPSS) version 26 for analysis. Data was analyzed using descriptive statistics and presented as tables and percentages. The X^2 test for independence was utilized in the bivariate analysis. A p-value of <0.05 was used as a cutting threshold for significant variables. Significant variables in the bivariate analysis were imported into the binary logistic regression. The variables that were significantly associated with DR were identified using binary logistic regression.

3.0 Results

3.1 Prevalence of Diabetes Retinopathy

As indicated in Figure 1, both eye clinical examination and fluorescein angiography were used to diagnose diabetes retinopathy, from this study(31.5%) of the study partakers were diagnosed with diabetic retinopathy, while (68.5%) of the study participants didn't have diabetic retinopathy.

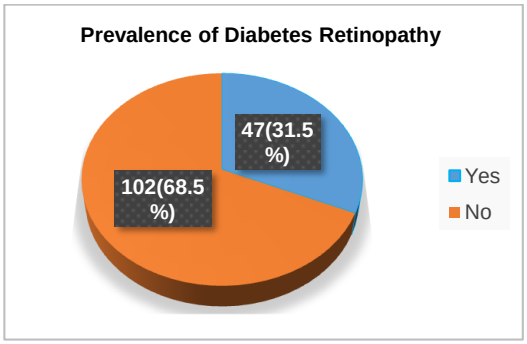

Figure 1: Prevalence of Diabetes Retinopathy

3.2 Descriptive Statistics on Social Demographic Factors

As indicated in Table 1, more than half(53%) of the study respondents were males.Regarding age, close to half(47%) of the study participants were aged between age 50-55 while only a few(16.1%) of the study respondents were aged 66-75 years. Concerning marital status, the majority(61.7%) of the study respondents were married. Regarding the level of education, close to half(49.7%) of the study participants in this study had attained a secondary level of education. Only a few (12.8%) of the respondents in this study had attained the tertiary level of education. In this study, the majority(82.6%) of the study participants were Christians as compared to Muslims who accounted for (17.4%). Finally, concerning the level of income, the majority(61.1%)of the study respondents reported earning a monthly income of above 6000 Ksh.

Table 1:Social Demographic Characteristics of the Study Respondents

Independent Variables	Categories	Frequency	Valid Percentage%
Gender	Male	79	53
	Female	70	47
Age	50-55	70	47
	56-65	55	36.9
	66-75	24	16.1
Marital Status	Single	29	19.5

	Married	92	61.7
	Divorced	9	6
	Separated	11	7.4
	Divorced	8	5.4
Educational Level	Never been to school	23	15.4
	Primary level	33	22.1
	Secondary level	74	49.7
	Tertiary level	19	12.8
Religion	Christian	123	82.6
	Religion	26	17.4
Income level	6000ksh and below	58	38.9
	6000 ks and above	91	61.1

Comment [S1]: Different data with same title, how?

3.3 Association between Social Demographic Factors and Diabetes Retinopathy

In the social demographic factors; gender type($X^2=6.256,df=1,p=0.012$), marital status($X^2=10.36,df=4,p=0.035$), an education level($X^2=35.707,\ df=3,p=0.000$), and income earned per month ($X^2=32.244,df=1,p=<0.000$), were statistically associated with diabetes retinopathy hence these variables were imported to binary logistic regression for further analysis. Type of religion($X^2=1.690,df=1,p=0.194$) and age($X^2=1.091,df=2,p=0.579$) were found not to be statistically associated with diabetes retinopathy. As indicated in Table 2, compared to diabetic patients with tertiary education, those with primary education had a 5.9 higher risk of developing diabetic retinopathy. From this study, study participants who earned less than 6000 Ksh per month had a 9-fold higher risk of developing diabetic retinopathy than their matched peers.

Table 2:Multivariate Analysis of Social Demographic Factors

Step 1a	B	S.E	Wald	Df	Sig	Exp(B)	95% C.I for EXP(B)	
							Lower	Upper
Marital status			6.634	4	0.157			
Single	2.12	1.08	3.888	1	0.049	8.331	1.01	68.53
Married	2.36	1.00	5.59	1	0.018	10.644	1.45	75.60
Divorced	2.31	1.33	3.04	1	0.08	10.09	0.75	135.68
Separated	1.35	1.27	1.19	1	0.28	3.99	0.33	47.90
Windowed						ref		
Education level			18.55	3	0.000			
Never been to school	-0.03	0.829	0.001	1	0.975	0.975	0.192	4.994
Primary	-1.75	0.769	5.17	1	0.02	0.17	0.03	0.79
Secondary	0.87	0.74	1.39	1	0.23	2.38	0.56	10.06
Tertiary						ref		
Gender	-0.63	0.49	1.69	1	0.19	0.53	0.21	1.37

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	Income below 6k	-2.19	0.486	20.32	1	0.000	0.112	0.043	0.290
	Income above 6k					ref			
	Constant	0.19	1.16	0.027	1	0.87	1.21		

3.4 Association between Health System Factors and Diabetes Retinopathy

In the health system factor associated with diabetic retinopathy, availability of diabetes mellitus medication(X^2=9.796,df=1,p=0.002), availability of diabetes mellitus laboratory testing services(X^2=54.022,df=1,p=<0.000), presence of diabetes mellitus support groups(X^2=21.102,df=1,p=<0.000), and the provision of diabetes mellitus healthcare messages(X^2=46.309,df=1,p=<0.000) were found to be associated with diabetic retinopathy, as a result, these variables were imported in the binary logistic regression for further analysis. Adherence to diabetes mellitus guidelines(X^2=0.682,df=1,p=0.409) was not associated with diabetic retinopathy.As indicated in Table 3, study participants who reported that laboratory test services were available were 10 times less likely to be diagnosed with diabetic retinopathy as compared to their fellow counterparts. In addition, participants in diabetes mellitus support groups had a 5.2-fold lower risk of developing diabetic retinopathy than those who didn't. Study respondents who reported receiving a healthcare message related to diabetes Mellitus were 11.6 less likely to experience diabetic retinopathy than their fellow counterparts

Table 3: Multivariate Analysis of Health System Factors

Step	**Variables**	**B**	**S.E**	**Wald**	**Df**	**Sig**	**Exp(B)**	**95% C.I for EXP(B)**	
1a								**Lower**	**Upper**
	Availability of medicines	0.40	0.57	0.499	1	0.48	1.49	0.49	4.53
							ref		
	Lab test available	2.35	0.55	18.12	1	0.00	10.49	3.56	30.99
							ref		

	Support group	1.65	0.54	9.43	1	0.002	5.19	1.81	14.85
							ref		
	Receiving a message on DR	2.45	0.62	15.82	1	0.00	11.56	3.46	38.59
							ref		
	Constant	-2.23	0.52	18.85	1	0.00	0.10		

3.5 Association between Lifestyle Factors and Diabetes Retinopathy

In the lifestyle factors associated with diabetic retinopathy, smoking(X^2=*28.575,df=1,p=<0.000*), drinking alcohol(X^2=*45.928,df=1,p*=<0.000*), body mass index(X^2=*98.485, df=3,p*=<0.000*), physical activities(X^2=*32.693,df=1,p=<0.000*) were found to be statistically significant with diabetes retinopathy hence they were imported for logistic regression analysis. Controlled blood pressure(X^2=*0.358,df=1,p=0.55*)and period lived with diabetes mellitus(X^2=*2.161,df=1,p=0.142*) were found not to be associated with diabetes mellitus. As indicated in Table 4, When compared to their peers, study participants who drank alcohol were 22 times more likely to develop diabetic retinopathy. Study participants who were smokers were 33.3 times more likely to be diagnosed with diabetic retinopathy as compared to their fellow counterparts. When compared to obese study participants, those with a normal body weight had a 3.6 times lower risk of developing diabetic retinopathy. In addition, study participants with uncontrolled blood sugars were 17 more likely than those with controlled blood sugars to develop diabetic retinopathy.

Table 4:Multivariate Analysis on Life Style Factors

Step 1a	**B**	**S.E**	**Wald**	**Df**	**Sig**	**Exp(B)**	**95% C.I for EXP(B)**	
							Lower	**Upper**
Drinking alcohol	-3.09	1.44	4.58	1	0.03	0.046	0.003	0.771
						ref		
smoking	-3.45	1.08	10.27	1	0.00	0.03	0.004	0.262
						ref		

BMI			19.74	3	0.00			
<18.5	5.66	1.73	10.69	1	0.00	2.86	9.651	85.085
18.-24.9	5.88	1.48	15.86	1	0.00	3.65	19.887	65.356
25-29.9	1.73	0.94	3.34	1	0.07	5.61	0.883	35.665
>30						ref		
Blood sugar under control	2.85	0.97	8.59	1	0.00	17.33	2.571	116.794
						ref		
Physical exercise	1.27	0.896	2.02	1	0.16	3.57	0.617	20.680
						ref		
Constant	-2.43	0.95	6.55	1	0.01	0.09		

4. Discussion

In this study, both eye clinical examination and fluorescein angiography were used to diagnose diabetes retinopathy, from this study(31.5%) of the study partakers were diagnosed with diabetic retinopathy. These findings were close to a study done in Australia which documented a prevalence of 34.6% among study participants[16].Compared to diabetic patients with tertiary education, those with primary education had a 5.9 higher risk of developing diabetic retinopathy. The need for better health-seeking behavior becomes more and more understood as one's education level rises. These findings were in agreement with another study done in China where being educated reduced the odds of having diabetes retinopathy[17].

Study participants who were earning less than 6000 Ksh per month had a 9-fold higher risk of developing diabetic retinopathy than their matched peers. The probable reason for this is that better income promotes the affordability of various health services related to diabetes management. These findings were in agreement with another study done in Ethiopia[18].Study participants who reported that laboratory test services were available were 10 times less likely to be diagnosed with diabetic retinopathy as compared to their fellow counterparts. This means the adequate provision of laboratory test services enables earlier detection of parameters that are likely to contribute to diabetic retinopathy. This study's results were in harmony with another study done in Amhara northwest of Ethiopia[19].

In addition, participants in diabetes mellitus support groups had a 5.2-fold lower risk of developing diabetic retinopathy than those who didn't. The presence of support groups ensures patients who have diabetes receive maximum care and treatment which reduces the odds of developing diabetes-related complications. These findings were in harmony with another study done in India[20]. Study respondents who reported receiving a healthcare message related to diabetes Mellitus were 11.6 less likely to experience diabetic retinopathy than their fellow counterparts. The provision of healthcare messages serves protective factor since it reminds diabetes patients to observe preventive measures as well as the need to comply with the prescribed regimen. These findings were in harmony with another study done in Germany[21].

When compared to their peers, study participants who drank alcohol were 22 times more likely to develop diabetic retinopathy. Drinking of alcohol among diabetes patients has been observed to be a risk factor for diabetes mellitus and its associated complication which include DR. These findings were in harmony with a study in Sweden[22].Study participants who were smokers were 33.3 times more likely to be diagnosed with diabetic retinopathy as compared to their fellow counterparts. Smoking has been linked to an increased risk of developing diabetes and its complications such as DR. These findings agreed with another study carried out in Russia[23]. When compared to obese study participants, those with a normal body weight had a 3.6 times lower risk of developing diabetic retinopathy. Being overweight and obese have been researched and have been recognized to be risk factors for diabetes complications such as diabetic retinopathy, These findings were in agreement with a study done in China[24]. Lastly, Study participants with uncontrolled blood sugars were 17 more likely than those with controlled blood sugars to develop diabetic retinopathy. Diabetes retinopathy is more likely to occur as a result of damaged nerves and blood vessels in the eye caused by elevated levels of sugar in the blood.These findings were in agreement with another study done in Cameroon[25].

5. Conclusion

The present investigation's prevalence of diabetic retinopathy was 31.5%, which was high indicating this is a public health concern requiring urgent interventions. In the social demographic factors, earning less than 6000 Ksh per month, and having a primary level of education increased the odds of having diabetes retinopathy. In the health system factors associated with diabetic retinopathy, the provision of laboratory testing services, the presence of a diabetes mellitus support group, and the provision of diabetes mellitus health messages reduced the odds of diabetes retinopathy. In the lifestyle factors, drinking alcohol, smoking, and the incidence of uncontrolled blood sugars augmented the odds of diabetes retinopathy while having a normal body mass index reduced the odds of having diabetes retinopathy. There is a need for joint action by concerned stakeholders to reduce the risk of diabetes retinopathy among diabetic patients.

9. Ethical Considerations

Ethical approval was sought from the MKU institutional and ethical review committee (ERC). An introduction letter was sought from MKU graduate school. NACOSTI granted the license to conduct the study. Additional approval was requested from the appropriate county offices (County Department of Health, County health committee, and HR Department). Consent forms were provided to the study participants before embarking on data collection. Participation in this study was purely voluntary. Study respondents' confidentiality and anonymity were highly upheld. Those who were found to be positive for DR were referred to an eye expert for appropriate treatment.

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Abbreviations

DM; Diabetes Mellitus, DME; Diabetic Macular Edema, DR; Diabetic Retinopathy, IDF; International Diabetes Federation, NACOSTI; National Commission for Science Technology and Innovation, SPSS; Statistical Package for Social Sciences,WHO; World Health Organization.

Comment [U3]: It must included in the running manuscript with first time explanation.