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Clinical characteristics and knowledge of diabetic retinopathy patients at a tertiary hospital in Aceh, Indonesia

Authors:
Lia M. Zaini[1,2]
Arief S. Kartasasmita[3]
Tjahjono D. Gondhowiardjo[4]
Maimun Syukri[5]
Putri N. Mulya[6]

Affiliations:
[1]Department of Medical Sciences, Faculty of Medicine, Padjadjaran University, Bandung, Indonesia

[2]Department of Ophthalmology, Faculty of Medicine, Zainoel Abidin Hospital, Syiah Kuala University, Banda Aceh, Indonesia

[3]Department of Ophthalmology, Faculty of Medicine, Cicendo National Eye Hospital, Padjadjaran University, Bandung, Indonesia

[4]Department of Ophthalmology, Faculty of Medicine, Cipto Mangunkusumo Hospital, University of Indonesia, Jakarta, Indonesia

[5]Department of Internal Medicine, Faculty of Medicine, Zainoel Abidin Hospital, Syiah Kuala University, Banda Aceh, Indonesia

[6]Faculty of Medicine, Zainoel Abidin Hospital, Syiah Kuala University, Banda Aceh, Indonesia

Corresponding author:
Lia Zaini,
liameuthiazaini@gmail.com

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Background: Diabetic retinopathy (DR) is a significant microvascular complication of diabetes mellitus, leading to vision impairment and blindness in working-age adults globally.

Aim: To evaluate the knowledge, clinical characteristics and associated factors among diabetic retinopathy patients attending an ophthalmology clinic at a tertiary hospital in Aceh from May 2020 to May 2021.

Setting: The study was conducted at Zainoel Abidin General Hospital, Banda Aceh, Indonesia.

Methods: A prospective cross-sectional study using consecutive sampling was conducted. Data collection involved patient history, eye examinations, laboratory tests and administering a questionnaire to assess knowledge of diabetes and diabetic retinopathy. The data were analysed using descriptive statistics and binary logistic regression.

Results: Out of 173 participants, 170 were included in the study. A significant proportion had visual acuity less than 6/60 (44.1%) and proliferative diabetic retinopathy (PDR) (52.6%) with macular oedema in 11.8%. Only seven (4.1%) patients had good knowledge of diabetes and 28 (16.5%) had good knowledge of DR. A total of 113 (66.5%) patients were aware that diabetes could affect the eye and positively associated with the sex (adjusted odds ratio [AOR]: 6.18, 95% confidence interval [CI]: 1.80–21.21, $P = 0.004$), educational level (AOR: 4.66, 95% CI: 1.31–16.51, $P = 0.017$) and type of DM (AOR: 5.30, 95% CI: 1.97–14.26, $P = 0.001$).

Conclusion: The study revealed a high incidence of vision-threatening diabetic retinopathy (VTDR), including severe non-proliferative, proliferative and significant macular oedema cases. However, patients' knowledge of their disease was very low.

Contribution: This study crucial data to the Department of Health Authority for policy decision-making.

Keywords: diabetic retinopathy; clinical characteristics; patient's knowledge; poor knowledge; vision-threatening.

Introduction

Diabetes mellitus (DM) is a global health concern affecting 537 million adults and over 1.2 million children worldwide.[1] Around three-quarters of diabetic patients reside in low-to-middle-income countries (LMICs), including Indonesia, which is ranked fifth in diabetes prevalence globally. Around 14.3 million Indonesian adults are believed to remain undiagnosed with diabetes.[2] In 2022, there was 189.464 people (3.5%) living with diabetes were diagnosed in Aceh Province, and only 57% of them are adequately controlled to primary care.[3] Previous research in the diabetic patient community in Aceh has shown that the most common complication is retinopathy. Approximately one in three respondents reported diabetic eye complications.[4] In Indonesia, it was estimated that one in every two patients with type 2 diabetes had some level of diabetic retinopathy (DR), while one in every four patients had vision-threatening diabetic retinopathy (VTDR).[5]

Diabetic retinopathy is a microvascular complication of DM, characterised by progressive retinal damage because of prolonged hyperglycaemia. This condition involves various stages, starting with non-proliferative diabetic retinopathy (NPDR), where capillary endothelial damage leads to

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microaneurysms, intraretinal haemorrhages and macular oedema. As the disease advances, it may progress to proliferative diabetic retinopathy (PDR), marked by neovascularisation resulting from retinal ischaemia. These newly formed vessels are fragile and prone to haemorrhages, potentially leading to vitreous haemorrhage, retinal detachment and severe vision loss.[6]

Vision-threatening diabetic retinopathy refers to the advanced stages of diabetic retinopathy, which include severe NPDR and PDR, as well as diabetic macular oedema (DME). Vision-threatening diabetic retinopathy significantly increases the risk of substantial visual impairment and blindness because of the critical involvement of the macula and the extensive proliferation of abnormal blood vessels. Effective management of VTDR typically involves a combination of glycaemic control, laser photocoagulation, intravitreal injections of anti-VEGF (vascular endothelial growth factor) agents and sometimes vitreoretinal surgery.[6,7]

In addition to the significant health impacts, DR also imposes a substantial economic burden. It was estimated that total healthcare costs caused by DR in Indonesia were $2.4 billion, accounted for nearly 2% of the national state budget in 2017 and are estimated to more than triple by 2025.[8] This highlights the urgent need for improved prevention and management strategies of diabetes and diabetic retinopathy. Screening for diabetic retinopathy is essential to identify cases that require timely comprehensive ophthalmic examination and treatment to prevent permanent vision loss. However, many countries lack sufficient resources for nationwide screening programmes.[9] This scarcity of resources is compounded by the fact that knowledge about DR is reported to be poor. It is predicted to be even worse in the region where diabetes patients do not adhere to recommended eye examination aimed to prevent visual impairment and blindness caused by DR.[10] To improve diabetes management in Indonesia, there is a necessity for heightened efforts aimed at primary and secondary prevention to reduce the prevalence and advancement of diabetic retinopathy.[11]

Comprehending patients' knowledge regarding diabetic retinopathy can assist health authorities in formulating strategies to reduce identifiable risk factors.[12] However, there is limited data on the knowledge of DR among patients in Indonesia, particularly in Aceh Province. The objective of this research is to assess clinical characteristics and patient knowledge regarding diabetic retinopathy among patients at an ophthalmology clinic at a tertiary hospital located in Aceh, Indonesia.

Research methods and design

This is a prospective hospital-based cross-sectional study conducted among diabetic retinopathy patients in the Department of Ophthalmology of Zainoel Abidin Hospital at Banda Aceh, Indonesia, from May 2020 to May 2021. Participants were selected using consecutive sampling within study the period. All eligible and willing patients aged 18 years and older were included. The exclusion criteria included patients who were unwilling to participate in the study and unable to cooperate with the interviewer because of various reasons such as severe cognitive impairment, communication barriers, language difficulties or any physical or mental condition that prevented effective interaction and reliable responses during the interview process.

Clinical characteristics of participants were assessed, including visual acuity (VA), classification of DR, ocular comorbidity, type of DM, duration of DM, body mass index (BMI) and risk factors. Laboratory data included HbA1c level, fasting plasma glucose (FPG) and low-density lipoprotein (LDL). Ophthalmic examination, encompassing assessments of visual acuity, classification of DR and identification of ocular comorbidities, was conducted by an ophthalmologist specialising in vitreoretinal. Visual acuity was assessed using the Snellen chart. The classification of DR is categorised based on the Early Treatment of Diabetic Retinopathy Study (ETDRS), including mild, moderate, severe and very severe NPDR and PDR.[13]

An interviewer gathered the information of each patient, including administering the questionnaire to assess their knowledge, demographics data, diabetes-related factors and laboratory data. The questionnaire consisted of two sections including diabetes section and diabetic retinopathy section. The questionnaire was adapted from a previous study conducted by Srinivasan et al.,[14] with modifications made to certain items to better suit the current research context (Appendix 1). A pilot study was conducted to identify practical problems during administration.

The diabetic section consisted of six questions that addressed the characterisation of diabetes, the screening, therapy, duration of treatment, organs affected by DM and specific ophthalmic complications caused by DM. This section has a maximum of 17 points. Good knowledge regarding diabetes was defined with a score of 9 or above. Meanwhile, the diabetic retinopathy knowledge section has a maximum score of 11 points. Good knowledge regarding diabetes was defined with a score of 5 or above. The score below the baseline was categorised as poor knowledge.

Statistical Package for the Social Sciences (SPSS) version 26 was used to analyse the data. Descriptive statistics including frequencies and percentages were used. Multinomial logistic regression was used to find significant associations between sociodemographic factors and awareness of DR. All statistical tests were deemed significant when observed within a 95% confidence interval, with statistical significance set at a p-value < 0.05.

The research protocol received approval from the Ethical Review Committee of the Faculty of Medicine at Universitas Syiah Kuala Number 065/EA/FK-RSUDZA/2020, registration number 1171012P. Written informed consent was obtained from all participants, ensuring their voluntary involvement in the study. The principles of privacy, confidentiality and adherence to ethical guidelines of the Declaration of Helsinki were meticulously upheld throughout the research process.

Ethical considerations

Ethical clearance to conduct this study was obtained from the Universitas Syiah Kuala Faculty of Medicine Ethics Review Committee (reference no.: 065/EA/FK-RSUDZA/2020).

Results

Sociodemographic characteristics of diabetic retinopathy patients

A total of 173 patients participated in this study. However, three were excluded because of their inability or unwillingness to complete the questionnaire. Thus, 170 patients took part in the study, with a mean age of 53.69 years. The demographic variables include sex, age, educational level, occupational status and residence. The majority, 89 (52.4%), were male. The largest proportion of the subjects were 129 (75.9%) aged 40–60 years, had a higher educational level 66 (38.8%) and work as non-government employees 64 (37.9%). A notable number of participants resided in Banda Aceh (43 individuals; 37.9%). A summary of the information is presented in Table 1.

Figure 1 represents the distribution of patients' residences across different districts in Aceh Province. There is a total of 23 cities and districts in Aceh Province and Banda Aceh is the capital city of the province. Banda Aceh is the most common residence among the patients, with 43 individuals accounting for 25.3% of the total. Pidie follows with 24 patients (14.1%), Aceh Besar with 23 patients (13.5%) and so on.

Clinical characteristics of diabetic retinopathy patients

The patients' clinical characteristics are presented in Table 2. Among participants, 150 (44.8%) had visual acuity less than 6/60 in their right eyes, and 79 (46.5%) had visual acuity less than 6/60 in their left eyes. In total, 128 eyes were classified as blind (VA less than 3/60), including 62 right eyes and 66 left eyes. Additionally, 26 (15.3%) patients were blind bilaterally, and 77 (45.3%) were blind unilaterally. Proliferative diabetic retinopathy predominantly occurred in males, with 45 cases in the right eye and 51 in the left eye. Among the participants, 94 (55.3%) were unaware of their diabetes type, while 56 (32.9%) had type 2 DM. Duration of diabetes between 10 and 15 years was reported by 58 (34.1%) individuals and 89 (52.4%) had normal weight. Additionally, hypertension was present in 144 (84.7%) of the participants and 108 (63.5%) had dyslipidaemia. Patients with a family history of diabetes were present in 91 (53.5%). The most common complications are non-healing wounds 47 (27.6%), cardiovascular disease 30 (17.6%), stroke 20 (11.8%), kidney disease 21 (12.4%) and diabetic foot 13 (7.6%). Among the participants, 71 (41.8%) had HbA1c > 9%, 119 (70%) had FPG > 125 mg/dL, LDL > 100 mg/dL.

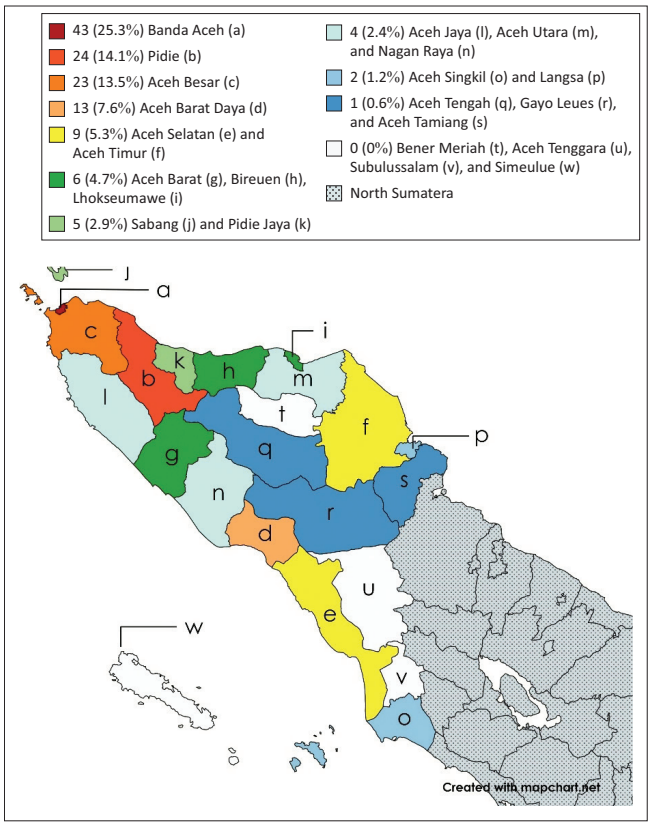
TABLE 1: Sociodemographic characteristics of the diabetic retinopathy patients (N = 170).

Variables	Frequency	%
Sex		
Male	89	52.4
Female	81	47.6
Age (years)		
< 40	6	3.5
40–60	129	75.9
> 60	35	20.6
Education		
Lower	52	30.6
Middle	52	30.6
Higher	66	38.8
Occupational status		
Government employee	35	20.6
Non-government employee	64	37.6
Retired	25	14.7
No job	46	27.1
Residence		
Urban	67	39.4
Rural	103	60.6

Note: Lower education: Elementary school and junior high school; Middle education: Senior high school; Higher education: Bachelor's degree, diploma and above.

Knowledge regarding diabetes and diabetic retinopathy among patients

Of the 170 patients, only 93 (54.7%) patients knew the definition of DM and seven (4.1%) had good knowledge about diabetes as shown in Table 3. The mean knowledge of diabetes score was 4.89 (standard deviation [s.d.] = 2.28), with a maximum attainable score of 11 and a minimum of 0. Patients with good knowledge of diabetic retinopathy



Note: This map was created by using mapchart.net.

FIGURE 1: Geographical distribution of patients' residence in Aceh Province.

TABLE 2: Clinical characteristics of the diabetic retinopathy patients.

Variables	Frequency	%
Visual acuity of right eye (RE)		
< 6/60	71	41.8
6/60–6/20	68	40.0
> 6/20	31	18.2
Visual acuity of left eye (LE)		
< 6/60	79	46.5
6/60–6/20	63	37.1
> 6/20	28	16.5
Classification of DR on RE		
Mild-moderate NPDR	14	8.2
Severe-very severe NPDR	56	32.9
PDR	86	50.6
Macular oedema	25	14.7
Classification of DR on LE		
Mild-moderate NPDR	18	10.6
Severe-very severe NPDR	44	25.9
PDR	93	54.7
Macular oedema	15	8.8
Ocular comorbidities		
Cataract	88	25.9
Glaucoma	21	6.2
Type of DM		
Type 1 DM	20	11.8
Type 2 DM	56	32.9
Unknown	94	55.3
Duration of DM (years)		
< 5	20	11.8
5–10	46	27.1
10–15	58	34.1
> 15	46	27.1
Body mass index		
Underweight (< 18.5)	5	2.9
Normal (18.5–24.9)	89	52.4
Overweight (25–29.9)	46	27.1
Obese (≥ 30)	10	5.9
Risk factors		
Hypertension	144	84.7
Dyslipidaemia	108	63.5
Family history of DM	91	53.5
HbA1c (%)		
< 7.0	22	12.9
7.0–8.9	54	31.8
≥ 9.0	71	41.8
Fasting plasma glucose (mg/dL)		
< 100	10	5.9
100–125	20	11.8
> 125	119	70.0
LDL (mg/dL)		
< 100	21	12.4
≥ 100	120	70.6

DR, diabetic retinopathy; DM, diabetes mellitus; HbA1c, glycated haemoglobin; LE, left eye; LDL, low-density lipoprotein; NPDR, non-proliferative diabetic retinopathy; PDR, proliferative diabetic retinopathy; RE, right eye.

constituted only 28 (16.5%). The mean knowledge of DR score was 2.23 (s.d. = 2.02), with a maximum score was 7 and a minimum score was 0. Out of the participants, 142 (83.5%) demonstrated poor knowledge regarding DR. Within this group, 72 (50%) were female, 34 (24%) lived in Banda Aceh, 110 (77%) within the age range of 40–60 years, 50 (35%) had a higher education level and 53 (37%) were non-government employees.

TABLE 3: Patients' knowledge regarding diabetes and diabetic retinopathy.

Knowledge	Knowledge regarding diabetes	%	Knowledge regarding diabetic retinopathy	%
Good	7	4.1	28	16.5
Poor	163	95.9	142	83.5
Total	**170**	-	**170**	-

Table 4 shows details of patients' responses to the questionnaire. The majority of patients knew how to keep their blood sugar levels under control; however, their knowledge was not comprehensive. They only answered one or two out of the five options provided and those responses were considered correct. A total of 113 (66.5%) patients were aware that diabetes could affect the eye, but only 17 (10%) patients were aware of diabetic retinopathy as an ocular complication of diabetes.

Of those patients who are aware that diabetes can affect the eye, we assessed its association with several demographic factors that could influence their awareness as shown in Table 5. Good awareness showed a positive association with sex, educational level and type of DM. Males had 6.18 times higher levels of awareness than females (AOR: 6.18; 95% CI: 1.80–21.21, *p*-value 0.004). Patients with higher educational levels tended to have better awareness than those with lower educational levels (AOR: 4.66, 95% CI: 1.31–16.51, *p*-value 0.017). Patients with type 2 DM had 5.3 times better awareness than those with unknown type (AOR: 5.30, 95% CI: 1.97–14.26, *p*-value 0.001).

Discussion

This is the first study assessing knowledge regarding diabetes and DR among DR patients in Aceh Province. A total of 170 subjects participated in the study conducted from May 2020 to May 2021. This study's results were comparable to those of previous studies conducted in different countries. Previous research on diabetes based on sex stated that men are more susceptible to diabetes because of obesity, which tends to develop more quickly in men than in women of the same age.[15] Our findings showed a higher incidence of DR in males (52.4%), with 89 cases. This suggests that there is no significant difference between the incidence of DR in females and males. These results also indicate the absence of gender disparity in accessing eye healthcare services for women like occurred in other countries.[16]

Diabetic retinopathy is the most common cause of vision impairment and blindness in individuals within the working age group.[17] This is consistent with our study, where the majority of subjects (75.9%) were within the 40–60 age range. Notably, 44.1% of all the eyes of the subjects had a visual acuity of less than 6/60, indicating significant vision loss among patients. Blindness is defined as presenting a distance visual acuity of 3/60 or less in the better eye or limitation of the field of vision to be less than 10 degrees from the centre of fixation.[18] In this study, 128 eyes were classified as blind, with 62 right eyes and 66 left eyes. Additionally, 26 (15.3%) patients were blind bilaterally and 77 (45.3%) were blind unilaterally. The worsening of visual acuity aligns with the

TABLE 4: Patients' responses to the questionnaire.

No.	Question	Correct	%	Incorrect	%
1	Diabetes mellitus is characterised by the elevation of blood glucose	93	54.7	77	45.3
2	Blood and/or urine tests are the tests done to diagnose diabetes	142	83.5	27	16.5
3	How can you keep diabetes under control?	150	88.2	20	11.8
4	Diet control and treatment should be done lifelong once diabetes is diagnosed	40	23.5	130	76.5
5	Diabetes can affect the eye	113	66.5	57	33.5
6	Diabetes can cause retinopathy	17	10.0	153	90.0
7	Diabetic retinopathy can cause blindness	75	44.1	95	55.9
8	Factors that cause progression or worsening of diabetic retinopathy	68	40.0	102	60.0
9	Treatment options available for diabetic retinopathy	60	35.3	110	64.7
10	A person with diabetic retinopathy can have normal vision	36	21.2	134	78.8
11	Patients with diabetes should have a periodic or regular dilated eye check-up to look for diabetic retinopathy	92	54.1	78	45.9
12	Patients with diabetes who have no diabetic retinopathy should have a dilated eye check-up once a year	21	12.4	149	87.6

TABLE 5: Factors influencing awareness of diabetic retinopathy.

Variables	Awareness of diabetes can affect the eye		AOR	95% CI	*p*
	Good	Poor			
Sex					
Male	68	21	6.18*	1.80–21.21*	0.004*
Female	45	36	1.00*	-	-
Age(years)					
< 40	5	1	2.98	0.207–42.99	0.422
40–60	82	47	0.95	0.96–3.09	0.957
> 60	26	9	1.00	-	-
Residence					
Urban	45	22	0.57	0.12–2.46	0.414
Rural	68	35	1.00	-	-
Educational level					
Higher	54	12	4.66*	1.31–16.51*	0.017*
Mid	33	19	1.63	0.63–4.28	0.306
Lower	26	26	1.00	-	-
Occupation					
Government	28	7	0.55	0.12–2.46	0.441
Non-government	41	23	0.26	0.64–1.07	0.064
Retired	20	5	0.26	0.06–1.07	0.347
No job	24	22	1.00	-	-
Duration of DM (years)					
< 5	12	8	0.95	0.24–3.75	0.948
5–10	26	20	0.85	0.29–2.4	0.769
10–15	44	14	2.13	0.73–6.2	0.162
>15	31	15	1.00	-	-
Type of DM					
Type 1	16	4	4.11	1.07–15.69	0.390
Type 2	48	8	5.30*	1.97–14.26*	0.001*
Unknown	49	45	1.00	-	-

AOR, adjusted odds ratio; CI, confidence interval; DM, diabetes mellitus.
*, statistical significance at $P < 0.01$.

advancing stages of diabetic retinopathy, highlighting the importance of early detection and intervention.

Our study revealed a high prevalence of VTDR among the participants. Vision-threatening diabetic retinopathy is a severe form of diabetic retinopathy that includes conditions such as severe NPDR, PDR and clinically significant macular oedema.[7] Proliferative diabetic retinopathy was prevalent, observed in 179 eyes (52.5%). This was followed by severe to very severe NPDR, which was found in 100 eyes (29.4%). Additionally, DME occurred in 40 eyes (11.8%). Diabetic macular oedema demonstrated links with high LDL levels and HDL/LDL ratios.[19] As found in this study, 120 (70.6%) patients had LDL levels above 100 mg/dL.

The incidence of DR is correlated with a longer duration of DM and the level of blood glucose. As observed in this study, 34.1% of patients had a duration of DM between 10 and 15 years. The highest HbA1c level observed in this study was in the group of subjects with an HbA1c level exceeding 9%. Lind et al.[20] concluded that an HbA1c level of > 8.6% poses a risk factor for retinopathy and nephropathy in both children and adults with type 1 diabetes. Alarming results showed high fasting blood glucose (FBG) levels and glycated haemoglobin (HbA1c) in patients, indicating poor diabetes control.

Figure 1 provides a clear depiction of the residential distribution of diabetic retinopathy patients attending the eye clinic at Zainoel Abidin Hospital in Banda Aceh. The majority of patients come from Banda Aceh and its surrounding areas, primarily because of the easier accessibility of eye health services in Banda Aceh. According to the Indonesian Medical Council, there are a total of 52 ophthalmologists in the Province of Aceh,[21] serving a population of 5.4 million.[22] The ratio of 1 ophthalmologist per 100 000 population has met the national target.[23] However, their distribution remains uneven, with 28 ophthalmologists concentrated in Banda Aceh as the capital city of the province and Aceh Besar Regency. Nine out of the 23 regencies in Aceh lack an ophthalmologist.[21] This imbalance is a significant factor contributing to the high prevalence of DR in these regions, alongside higher population density. Eye health screening, particularly for DR, is markedly low in peripheral areas because of the absence of ophthalmologists, resulting in no referrals to secondary and tertiary hospitals as observed in this study. Additionally, limited patient knowledge exacerbates this issue.

The assessment of knowledge regarding diabetes and DR through a questionnaire revealed a remarkably low value, where only seven (4.1%) patients exhibited good knowledge of DM and 28 (16.5%) of DR. This represents one of the lowest rates recorded in research conducted thus far. The findings regarding knowledge of DR in our study were higher than the previous study in which the questionnaire was adapted. Srinivasan et al.[14] reported that 42% had good knowledge about diabetes and 4.5% had good knowledge regarding DR. Previous studies reported knowledge about diabetes is so much higher than knowledge about diabetic retinopathy. The difference is probably because of the setting and study participants. In our study, the participants were diabetic retinopathy patients attending an ophthalmology clinic and had already been informed about their condition following consultation. Therefore, their knowledge about DR was slightly higher than the knowledge of DM.

This study documented both knowledge and awareness of diabetic retinopathy patients. It is important to differentiate between awareness and knowledge. A total of 113 (66.5%) patients were aware that diabetes could affect the eye and 153 (90%) patients were unaware of diabetic retinopathy as an ocular complication of diabetes. Our study findings were lower than those of previous studies conducted in Papua New Guinea and Turkey, which assessed the knowledge and awareness of diabetes and diabetic retinopathy among patients seeking eye care. In these studies, 71.4% and 88.1% of participants, respectively, knew that diabetes can affect the eye.[24,25] The percentage of patients who were not aware of their diabetic retinopathy diagnosis was also reported to be high in the United States of America, at 70.1%.[26]

This study showed significant associations between patient awareness of diabetes can affect the eye with sex, education level and type of diabetes. Good awareness showed a positive association with, educational level and type of DM. Males had 6.18 times higher levels of awareness than females (AOR: 6.18, 95% CI: 1.80–21.21, *p*-value 0.004). Patients with higher educational levels tended to have better awareness than those with lower educational levels (AOR: 4.66, 95% CI: 1.31–16.51, *p*-value 0.017). Patients with type 2 DM had 5.3 times better awareness than those with unknown type (AOR: 5.30, 95% CI: 1.97–14.26, *p*-value 0.001). However, age, residence and diabetes duration exhibited no significant correlation with patient awareness. These findings were in line with a previous study conducted in Jordan that 66.88% of patients were unaware of DR, and lower level of education, female sex, younger age and shorter duration of DM were associated with less awareness.[27]

Educational and screening programmes for DR are crucial components of diabetes management, playing a significant role in enhancing patient knowledge, early detection and overall health outcomes. Educational programmes empower patients with the necessary knowledge to manage their diabetes effectively, recognise early symptoms of DR and seek timely medical attention, thus preventing the progression of the disease and reducing the risk of severe vision loss. These programmes also support caregivers and families, helping them provide better care and support to patients.

Screening programmes are vital for the early identification of at-risk individuals, allowing for prompt and targeted interventions that can prevent vision loss. They raise patient awareness about the importance of regular eye exams and contribute to the overall public health effort to reduce diabetes-related complications. Additionally, screening programmes provide valuable data for research and help address healthcare disparities by ensuring access to eye care services for all patients, regardless of their socio-economic status or location. By prioritising these educational and screening initiatives, healthcare systems can improve patient outcomes, prevent complications and reduce healthcare costs, ultimately enhancing the quality of life for individuals with diabetes.

Limitations

One key limitation of this study is the absence of a specific sample size calculation. We used consecutive sampling, including all eligible participants within a certain time frame. With only 170 respondents, the study has an approximate margin of error of 7.5%, which could influence the accuracy and generalisability of the findings. The small sample size limits the reliability of the results, and further studies with larger samples are needed to draw more accurate conclusions. While we acknowledge the impact of sample size on the generalisability, the results still provide valuable insights into the clinical characteristics and knowledge of patients at our hospital in Aceh Province, Indonesia, where diabetic retinopathy is still largely undiagnosed.

Other limitations include incomplete laboratory data, where values for HbA1c (missing for 23 participants), FPG (missing for 21 participants) and LDL (missing for 29 participants) were unavailable, hindering thorough analysis. Additionally, BMI data were missing for 20 participants.

Conclusion

The study underscores the importance of enhancing awareness and knowledge of diabetic retinopathy among patients with diabetes. Early detection and timely intervention are crucial for preventing the progression of diabetic retinopathy and reducing the risk of vision loss. Our findings provide valuable insights for healthcare providers and policymakers to implement targeted educational initiatives and improve the overall management of diabetic retinopathy in Aceh Province, Indonesia.

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Competing interests

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

Authors' contributions

L.M.Z., A.S.K., T.D.G. and M.S. were responsible for the study concept and methodology. L.M.Z. and P.N.M. conducted the study, retrieved, analysed and interpreted the data and prepared the article. L.M.Z., A.S.K., T.D.G., M.S. and P.N.M. were involved in writing, critical review and editing the final article.

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Data availability

The data that support the findings of this study are available upon request from the corresponding author, L.M.Z.

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Appendix 1 starts on the next page →

Appendix 1

Questionnaire

The questionnaire was administered by a trained interviewer. Correct answers to the questions are highlighted and scored 1 point for each.

1. **Diabetes mellitus is characterised by:**
   a. Elevation of blood glucose
   b. Elevation of blood pressure
   c. Elevation of cholesterol
   d. Do not know
   e. Any other (specify)

2. **What tests are done to diagnose diabetes?**
   a. Blood tests
   b. Urine tests
   c. Any other (specify)

3. **How can diabetes be managed?**
   a. Medication
   b. Diet
   c. Exercise
   d. Weight reduction
   e. Regular check-ups
   f. Do not know
   g. Any other (specify)

4. **Once diagnosed, how long should diabetes treatment/diet control continue?**
   a. Until sugar levels are controlled
   b. Lifelong
   c. Any other (specify)

5. **Which body parts are affected by diabetes?**
   a. Kidneys
   b. Feet
   c. Eyes
   d. Nerves
   e. Heart
   f. Do not know
   g. Any other (specify)

If option c (eyes) is selected in question 5, proceed to question 6. If not, the administration of the questionnaire should be discontinued, and the knowledge score of DR is 0.

6. **What eye problems can diabetic patients experience?**
   a. Cataract
   b. Retinopathy (damage to the retina/nerve at the back of the eye because of diabetes)
   c. Eye infections
   d. Defective vision
   e. Do not know
   f. Any other (specify)

Total score for knowledge regarding diabetes: 17
Good knowledge: Score of 9 and above
Poor knowledge: Score of less than 9

7. **How many years after diagnosis, diabetes can cause retinopathy?**
   a. At the time of diagnosis
   b. Any other (specify the time interval in years since diagnosis)

8. **Can diabetic retinopathy cause blindness?**
   a. Yes
   b. No
   c. Do not know

9. **What factors worsen diabetic retinopathy?**
   a. Poor diabetes control
   b. Hypertension
   c. Nephropathy
   d. Anemia
   e. Do not know
   f. Any other (specify)

10. **What treatment options are available for diabetic retinopathy?**
    a. Spectacles
    b. Laser
    c. Surgery
    d. Eye injections
    e. Do not know
    f. Any other (specify)

11. **Can someone with diabetic retinopathy have normal vision?**
    a. Yes
    b. No
    c. Do not know

12. **Should diabetic patients have regular dilated eye check-ups to look for retinopathy?**
    a. Yes > proceed to Question 13
    b. No
    c. Do not know

13. **How often should diabetic patients without retinopathy have a dilated eye check-up?**
    a. Once in 6 months
    b. Once a year
    c. Once in 2 years
    d. Once in 5 years
    e. Do not know
    f. Any other (specify)

Total score for knowledge regarding diabetic retinopathy: 11
Good knowledge: Score of 5 and above
Poor knowledge: Score of less than 5