The Relation Between Awareness Of Diabetic Retinopathy And Its Grade In Libyan Diabetic Patients

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Abstract

Background: Background: Diabetic retinopathy (DR), a prevalent vision-threatening complication, necessitates effective screening and management. This study aimed to assess DR awareness and attitudes among Libyan diabetic patients (type 2) and determine their association with the DR stage.

Aim: to determine the link between the diabetic retinopathy stage and the awareness and attitude of Libyan diabetic patients regarding diabetic retinopathy.

Methodology: a conventional descriptive cross-sectional study involved Libyan diabetic patients (type 2) aged 40-90 from "Benghazi Center for Diagnosis and Treatment Diabetes Mellitus". A validated questionnaire assessed DR awareness and attitude, while slit-lamp and ETDRS grading determined the DR stage.

The result: most of the patients (80%) had a regular follow-up in a diabetic clinic, while only 19% had regular follow-ups in an eye clinic, and 55% of them had no previous eye examination. Lack of knowledge about diabetic retinopathy accounted for 37% of patients. The absence of eye signs and symptoms was cited by 19% as a cause of irregular eye clinic follow-up. Furthermore, only 44% of patients (versus 56%) had a referral from their doctor, suggesting an inadequate degree of physician involvement in retinopathy screening.

Conclusions: Despite DR's known visual impairment risk, Libyan diabetic patients exhibited significant gaps in awareness and regular eye clinic follow-up, even if asymptomatic. Physician involvement in retinopathy screening was also inadequate. These findings highlight the need for targeted educational interventions for patients and physicians to address knowledge gaps and promote regular eye examinations for early DR detection and improved visual outcomes.

Keywords – Diabetic Retinopathy, Awareness, Libyan Patient, Diabetes Mellitus.

Introduction:

Background: One of the most prevalent microvascular complications of diabetes mellitus is diabetic retinopathy, where among the 285 million diabetic patients worldwide, one-third of them have diabetic retinopathy. Furthermore; one-third of diabetic retinopathy patients have a vision-threatening retinal change [1] This makes DR one of the major preventable causes of blindness globally. Its occurrence is correlated with the patient's age, the duration of the disease, and the presence of certain risk factors, such as pregnancy, hypertension, and renal disease. [2]

Diabetes mellitus is an endocrinal disorder characterized by hyperglycemic conditions. The continuation of the hyperglycemic state will cause nonenzymatic glycation of proteins and lipids, which in turn will result in endothelial damage to the retinal capillary.

Leading to retinal changes such as; microaneurysms, dots and blots hemorrhage, intraretinal microvascular abnormality, and cotton wall spots. All previous changes are considered non-proliferative diabetic retinopathy [2, 3].

If the prior changes are not stopped, the ischemia stimulation of retinal cells will continue, which will cause the pro-angiogenic factor VEGF to be secreted. This, in turn, will stimulate neovascularization to bypass those occluded vessels, which may occur at the optic disc (also known as NVD), retina (also known as NVE), or iris (also known as rubeosis iridis, NVI). Fragile neovascularization in diabetic retinopathy is a leading cause of vitreous hemorrhage and subsequent tractional retinal detachment. [2]

Therefore, diabetic retinopathy can be categorized into a variety of classes based on the mydriatic fundus examination of the eye. One such classification is the International Clinical Diabetic Retinopathy stages (ICDR) as shown in the table1.

Table 1: shows international clinical diabetic retinopathy stages:

Disease severity level:	Description	Finding observable on mydriatic fundus photo or examination:
Grade 0	No apparent retinopathy.	No positive finding.
Grade 1	Mild NPDR.	Microaneurysm only.
Grade 2	Moderate NPDR.	There are microaneurysms, dot, blot hemorrhage, and hard and soft exudation but don't apply to severe NPDR roles.
Grade 3	Severe NPDR.	Any one of the following: 20 or more dot blot hemorrhage in each of the four quadrants. Venous beading in two or more quadrants. IRMA (intraretinal microvascular abnormalities) in one or more quadrants. Of course, in the absence of any neovascularization.
Grade 4	PDR.	Neovascularization of the disc, iris, angle, or elsewhere in the retina. Or vitreous or retinal hemorrhage.

NPDR: non-proliferative diabetic retinopathy, PDR: proliferative diabetic retinopathy [4]

The appropriate frequency of follow-up and the next phase of treatment must be determined based on the stage of diabetic retinopathy. This shows the importance of these periodic follow-ups to mitigate such risks.

Despite research efforts in Libya to understand the prevalence of diabetic retinopathy and its connections to other health conditions, age, and diabetes management, little is known about patients' perspectives on this eye disease. This study addresses this by investigating diabetic patients' level of awareness and attitudes towards diabetic retinopathy, to determine how these aspects are associated with the severity of their disease.

Methodology:

Study data: This descriptive cross-sectional study explored the perspectives of individuals with type 2 diabetes mellitus (T2DM) in Benghazi, Libya, regarding diabetic retinopathy (DR). Participants, ranging from 40 to 90 years old, were recruited regardless of pre-existing risk factors or diabetic complications. Data collection occurred between September and October 2023 through bi-weekly visits to the Benghazi Center for the Diagnosis and Treatment of Diabetes (CDT), the city's premier tertiary-level facility for diabetic care. This strategic access to a diverse patient population facilitated a comprehensive understanding of local perspectives on DR, independent of individual clinical profiles.

Data Collection and Study Procedures:

Following formal ethical approval and participant consent, a three-part, Arabic-language interview questionnaire was administered to each patient in complete privacy. The first section (six questions) collected demographic data. The second section (ten questions) investigated diabetes management, including diagnosis date, HbA1c levels (controlled defined as <7%), clinic follow-up (diabetic clinic: every 1-2 months; eye clinic: every 6 months-1 year), and prior retinal examinations. The final section (six questions, adapted from a pre-validated questionnaire) assessed participants' knowledge of diabetic retinopathy, information sources, and reasons for potential irregular follow-up (eight additional questions; optional).

Subsequently, a comprehensive ophthalmic examination was conducted on each participant. Visual acuity was measured using a Log MAR chart. A slit-lamp examination ruled out corneal opacities and identified any relevant findings. Intraocular pressure (IOP) was assessed to rule out glaucoma. Diabetic retinopathy staging followed the Early Treatment of Diabetic Retinopathy Study (ETDRS) criteria, utilizing a traditional fundus camera, smartphone fundus camera, or mydriatic fundus examination (or a combination) based on equipment availability at the time of examination.

Exclusion criteria included lack of informed consent, recent intraocular surgery, corneal opacities, or any active ophthalmic pathology.

Data Analysis and Statistical Testing:

Statistical analysis was conducted using IBM SPSS Statistics 23. All questions in Section 3 of the questionnaire, about patient awareness of diabetic retinopathy, were assigned equal weight except for the final two items regarding reasons for irregular eye examinations and information sources. Based on their responses, participants were categorized as "aware" if they answered correctly to >60% of awareness questions, and "unaware" if they answered incorrectly or left blank >40% of the questions.

The correlations between various factors and diabetic retinopathy stages were tested using the chi-square test. These factors included:

- Level of education (categorized according to national education system)

- Duration since the first visit to the eye clinic

- Regularity of follow-up in the eye clinic (based on the defined frequency)

- Patient awareness as classified earlier

A p-value <0.05 was considered statistically significant for all tests.

Benghazi Center data: The "Benghazi Center for the Diagnosis and Treatment of Diabetes" is where the sample was obtained. It was established in 1969 and is considered one of the oldest and largest diabetic centers registered in the world [5]. The center is the only diabetic center in Benghazi municipality and supervises a diabetic clinic in the eastern of Benghazi, its services are free of charge, and patients are provided with their oral hypoglycemic drugs, insulin syringes, and insulin.

Ethical consideration:

The responsible body to give the Ethical approval for this study is the Libyan National Committee for Biosafety and Bioethics, adhering to national regulations. Additionally, endorsements were obtained from key local stakeholders: the Benghazi Health Services Department, the Benghazi Center for Diagnosis and Treatment of Diabetes, and the Ophthalmology Department. Further strengthening the review process, a dedicated committee of three Associate Professors of Ophthalmology meticulously assessed the research proposal, ensuring compliance with ethical guidelines and rigor in methodology

Result:

This study investigated diabetic retinopathy in a diverse sample of 100 Libyan individuals with type 2 diabetes, encompassing a gender distribution of 69% female and 31% male, and an age range of 40 to 80 years (mean: 56.7 years +/- 10). Participants' demographic backgrounds are provided about patient awareness tested by the third part of our questionnaire are illustrated in Table 2:

Table 2 illustrates the level of education of study participants:

Variants		aware	unaware
Gender:	male:	18	13
	Female:	38	31
education	College:	1	0
	Elementary:	2	4
	High diploma:	19	7
	Non:	16	15
	Primary school:	13	12
	Secondary school:	5	6
Residency:			
Benghazi:		54	37
The suburbs of Benghazi:		2	7
Work:			
Teacher:		10	1
Free business:		4	6
Housewife:		27	27
Nurse:		2	1
Others:		13	9

Reflecting the gender distribution with 69% females, 54% of the participants identified as housewives. Comorbidity prevalence was equally split between those with no comorbidities (50%) While the others had either hypertension (42%), with a small minority having renal (1%) or thyroid (5%) disease.

Looking to the second part of the questionnaire, the time of diabetes mellitus diagnosis is illustrated in Table 3:

Table 3: shows the result of the second part of the questionnaire that determines the state and attitude of diabetic patients toward diabetes and diabetic retinopathy:

	aware	unaware
Diabetic since:		
Before 2000:	4	4
Between 2000 to 2010:	16	8
Between 2010 to 2020:	28	25
Between 2020 to 2023:	8	7
Control of diabetes mellitus:		
Controlled:	13	14
Uncontrolled:	43	30
Time of first retinal examination:		
Non:	21	34
One year:	17	6
Three years or less:	7	2
Five years or more:	11	2
Retinal state at first eye examination:		
No previous eye examination:		
No diabetic change:	22	33
Mild retinal change:	30	10
Severe retinal change:	4	0
	0	1
Follow-up at the diabetic clinic:		
Monthly:	46	34
Every 2 months:	5	2
Irregular follow-up:	5	8
Follow-up at eye clinic:		
Every 6 months:	1	0

Annularly:	16	2
Irregular follow-up:	39	42
Co-morbidity:		
Hypertension:	23	19
Renal disease:	1	0
Others:	4	3
Non:	28	22

Diabetic clinic follow-up adherence was significantly higher compared to retinal clinic attendance. Within the diabetic clinic, 87% maintained regular visits (80% monthly, 7% every two months), while only 13% were irregular. Conversely, retinal clinic follow-up was predominantly irregular (81%), with only 18% attending yearly and 1% every six months.

Patient awareness was assessed through an eight-question section in the questionnaire. Six questions probed knowledge of diabetic retinopathy, while the remaining two explored reasons for irregular retinal clinic follow-up and the source of the knowledge. Table 4 presents the detailed results.
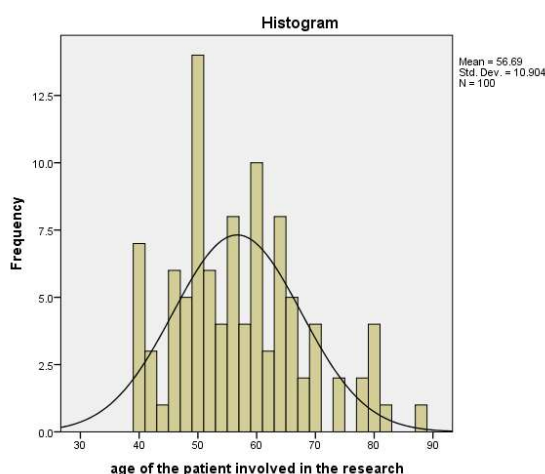

Figure 1: Histogram which illustrates the age of the patients that involved in this study.

Table 4: illustrate the answers of the patients on the third part of the questionnaire, the part that tests the patient's awareness:

Question:	Answer and its frequency:	total
1-Does the diabetes cause blindness?	Yes: 97 No:3	100
2-Does good blood sugar control prevent diabetic retinopathy?	Yes:76 No: 24	100
3-Is diabetic retinopathy treatable?	Yes:62 No:38	100

4-Time of undertaken first retinal examination?	This time:85 Previously:15	100
5-Are you referred by a health professional/worker for an eye examination?	Yes:44 No:56	100
6-How frequently should you undergo eye examination R/O diabetic retinopathy?	6 months:24 Annually:14 Only when vision decreases Not aware about frequency:60	100
7-Reason for not undertaking eye/retinal examination:	Lack of knowledge about diabetic retinopathy: 37 From remote area:2 Lack of time:5 Lack of money:2 No vision problem:19 Other reason:34 I'm regular F/U:1	100
8-What is the source of your knowledge about diabetes/diabetic retinopathy:	Doctor:23 Freiends:4. Relative:16 Mass media:2 Personal effort:46 Not aware:9	100

Scoring involved awarding one point for a correct answer on the first six items while the final two questions had a multiple-option answer. Individual total scores were then calculated, with a threshold of 60% defining awareness and below 60% indicating unawareness. This assessment revealed that 56% of participants demonstrated awareness of diabetic retinopathy, while 44% did not.

Ophthalmic examination revealed that 59% of participants possessed excellent best-corrected visual acuity (1 or 0.9 log MAR chart), with only 5% exhibiting moderate visual impairment (log MAR $\geq$ 0.3). Additionally, 56% presented with no cataracts or only mild, ones that don't interfere with fundus examination. Intraocular pressure remained within normal limits across all participants.

ETDRS staging was used to classify diabetic retinopathy severity. Table 5 presents the resulting ETDRS stage distribution for each participant's most affected eye.

Table 5: illustrates the frequency of the retinopathy stage of more affected eyes for each participant about its awareness according to the third part of the survey:

Stage of the more affected eye:	aware:	Unaware:
No diabetic retinopathy:	38	34
Mild non-proliferative:	4	0
Moderate non-proliferative:	10	4
Severe non-proliferative:	2	5
Proliferative:	1	1
Advance proliferative:	1	1

Also, when we did the proportional correlation between regular eye examination follow-up and severity of retinopathy, we found a weak correlation (p-value 0.91%).

By looking at the proportional correlation between the stage of more severe eye and the level of patient education, also there was no correlation (p-value 0.93%), on the other hand, there was a strong correlation between patient awareness and follow-up regularity in eye clinic (p-value 0.005%)

Contrary to the hypothesis, there was no statistically significant correlation observed between the time elapsed since the first eye examination and the stage of diabetic retinopathy (p-value = 0.99). This suggests that factors beyond early diagnosis, such as individual risk factors, disease heterogeneity, and educating the patients about the benefit of regular follow-up, likely play a more prominent role in determining disease progression.

While a statistically weak correlation was found between adherence to regular eye examinations and retinopathy severity (p-value = 0.91%), this suggests some potential benefit to maintaining frequent screening schedules. Further investigation is warranted to explore the precise nature and magnitude of this relationship, accounting for factors like the quality of examinations and individual disease trajectories.

The analysis revealed no statistically significant correlation between the level of patient education and the stage of the more severely affected eye (p-value = 0.93%). On the other hand, a significant and positive correlation was observed between patient awareness of diabetic retinopathy and their regularity in attending follow-up eye examinations (p-value = 0.005%). This finding underscores the critical importance of robust public health initiatives and educational interventions in promoting awareness and proactive engagement with eye care services, ultimately leading to earlier disease detection and potentially improved patient outcomes.

Table 6: Crosstabs illustrate the relation between the stage of diabetic retinopathy and each of the following: time of first eye examination, level of patient education, regularity of follow-up in the eye clinic, and patient awareness according to our survey result:

Variants:	No diabetic change:	Mild NPDR:	Moderate NPDR:	Severe NPDR:	PDR:	Advance PDR:	P-value:	Pearson chi-square:
Time of first retinal examination:							0.99%	19.7
Non:	38	0	9	6	1	1		
One year:	15	3	3	1	0	1		
Three years or less:	8	1	1	0	0	0		
Five years or more:	11	0	1	0	0	0		
Education							0.93%	15.33
College:	1	0	0	0	0	0		
Elementary	5	1	0	0	0	0		
High diploma:	19	1	3	2	1	0		
Non:	24	0	4	2	0	1		
Primary school:	16	2	5	2	0	0		
Secondary school:	7	0	2	1	0	1		
Follow-up at eye clinic:							0.91%	4.58
Every 6 months:	1	0	0	0	0	0		
Annularly:	55	4	12	7	1	2		
Irregular follow-up:	16	0	2	0	0	0		
Awareness of the patients according to the third part of the survey:							0.17%	7.75
Aware:	38	4	10	2	1	1		
Unaware:	34	0	4	5	0	1		

Table 7: correlation between patient awareness and their regular follow-up:

awareness * follow up of retina every: Crosstabulation:
(Pearson Chi-square=10.71, p-value=0.005%)
significant correlation.

Count

Awareness	follow up of retina every:			Total
	6 months	irregular	yearly	
Aware	1	39	16	56
Unaware	0	42	2	44
Total	1	81	18	100

Discussion:

Diabetic retinopathy, a leading cause of blindness globally across both developed and developing nations, particularly during middle and older age, poses a significant public health challenge. Characterized as an "iceberg disease," its true prevalence likely surpasses the documented 34.6% due to underdiagnosis. Effective screening programs are therefore crucial to detect and manage this vision-threatening condition early. These programs can be implemented through routine mydriatic fundus examinations performed by ophthalmologists or fundus camera usage by trained healthcare professionals, particularly in settings lacking specialized retinal specialists. Standardized parameters for diabetic retinopathy staging and treatment are critical for guiding effective interventions and monitoring disease progression. This necessitates continuous research and evaluation, particularly with new imaging technologies like ultra-widefield retinal imaging, OCT, artificial intelligence, and smartphone fundus cameras.

Our study sheds light on the complex interplay between patient awareness, knowledge, and behavior regarding diabetic retinopathy management. While 56% of participants demonstrated awareness of the disease, a striking 81% exhibited irregular follow-up, highlighting inconsistencies between knowledge and action. Only 19% adhered to recommended annual or biannual eye examinations, indicating a substantial gap in compliance. Furthermore, 60% were unaware of the ideal follow-up frequency, suggesting a significant knowledge deficit impacting their ability to prioritize regular evaluations. These findings emphasize the need for multifaceted interventions to bridge the gap between awareness and behavior change.

Interestingly, our analysis revealed a weak correlation between regular follow-up and the stage of diabetic retinopathy (p-value=0.91%). This could be attributed to the high proportion of participants with no detectable retinal changes, potentially masking the true relationship between adherence and disease severity. Similarly, no significant correlations were observed between the first eye examination and the stage of the more affected eye (p-value=0.99%), or between patient education level and disease severity (p-value=0.93%). These findings underscore the multifaceted nature of diabetic retinopathy and the need for further research to identify the specific factors influencing disease progression and patient behavior.

However, a strong positive correlation emerged between patient awareness and follow-up regularity (p-value=0.005). This highlights the critical role of effective patient education in promoting adherence to screening programs. Notably, the most frequent reasons for irregular follow-up were a lack of knowledge about the importance of eye examinations and the absence of symptoms, implying a deficit in understanding the asymptomatic nature of early-stage diabetic retinopathy. These findings further emphasize the need for tailored interventions targeted at both patients and healthcare professionals to raise awareness and understanding of the importance of consistent eye examinations, even in the absence of immediate symptoms.

Finally, the near-identical distribution of patient referrals by physicians and self-motivated individuals (44 vs. 56) signifies a need for heightened awareness among both parties regarding optimal follow-up protocols for diabetic eye examinations. Collaborative efforts involving healthcare professionals, patient education programs, and public health initiatives are crucial for effectively managing diabetic retinopathy and preventing vision loss.

Our study reinforces existing evidence highlighting the incongruence between patient awareness of diabetic retinopathy and their engagement in crucial follow-up practices. Aligned with the findings of Alzahrani et al. (2022) in Abha [6], Saudi Arabia, although participants demonstrated knowledge of diabetic retinopathy as a vision-threatening condition, a significant proportion lacked comprehension of the vital role of regular eye examinations in early detection and intervention. This corroborates the conclusions of Gupta et al. (2020) [7], who emphasized the need to bridge the gap between awareness and behavior change through targeted patient education programs.

Interestingly, our findings diverge from those reported by Al-Majali et al. (2023) in Jordan [8], who observed a positive correlation between patient awareness and education level. This discrepancy could be attributed to several factors, including regional variations in population demographics, cultural influences on healthcare information access and utilization, or methodological differences between studies. Further research is warranted to explore these potential explanations and elucidate the complex interplay between knowledge, education, and behavior in the context of diabetic retinopathy management.

Furthermore, our analysis echoes the observations of Al-Khamis et al. (2022) [9] regarding the potential need for enhanced physician involvement in educating patients about the benefits of diabetic retinopathy screening. This is evident in the similarities between our findings and the conclusions of the aforementioned study, which identified gaps in healthcare providers' knowledge and practices related to diabetic retinopathy education. Recognizing this gap underscores the value of targeted interventions aimed at equipping physicians with the necessary skills and resources to effectively educate their patients about the importance of regular eye examinations.

In conclusion, our study builds upon existing knowledge by adding to the growing body of evidence highlighting the disconnect between patient awareness of diabetic retinopathy and their adherence to recommended follow-up protocols. Addressing this discrepancy necessitates multifaceted interventions targeting both patients and healthcare providers. Effective patient education programs and initiatives focusing on physician education and skills development are crucial for bridging the gap between knowledge and action, ultimately promoting successful diabetic retinopathy management and optimizing visual health outcomes.

Table 8: briefly explain the previously mentioned study:

Name of the study:	Aim, Sample orientation.	Concern conclusion.
Prevalence and Awareness of Diabetic Retinopathy in Diabetic Patients Visiting Tertiary Care Hospitals in Central India.	2023, in the cross-sectional study, of 40 diabetic patients, only 42.5% of patients had diabetic retinopathy.	Timely screening of patients and intervention can go a long way in reducing morbidity or vision loss. [7]
Awareness of diabetic retinopathy among patients with type-2 diabetes mellitus in Abha, Saudi Arabia in 2022: A survey-based research study	test awareness and attitude of type two diabetes mellitus toward the diabetic retinopathy, questionnaire, involved 381 participants.	The conclusion was that there is high awareness about the complications of diabetes mellitus on the eye and the importance of eye examination. however, most of them are not aware of the value of regular ophthalmic follow-up [6].

Evaluating Awareness and Practices Towards Diabetes and Diabetic Retinopathy in Adult Patients Attending the Eye Clinic in a Tertiary Academic Hospital in Jordan.	The 2021, cohort study, aimed to test the awareness of diabetic patients about diabetic retinopathy, included 176 diabetic patients of type 2, who attended the ophthalmology clinic at Jordan University Hospital	Conclusion: was that the awareness among the patient is low, it correlated with the patient's education and level of HbA1c reading. The study emphasizes on role of communication strategies in establishing screening programs and effective strategies to treat visual complications. [8]
"Knowledge, attitudes, and practices regarding diabetic retinopathy among primary health care physicians in Al-Hasa, Saudi Arabia"	cross-sectional study, aimed to test the knowledge, attitudes, and practices of primary health care physicians in Al-Hasa. self-administered questionnaire, 141 physicians, and 63 centers.	Conclusion: present of a gap in applying the correct guidelines, however, overall attitudes toward patient education are satisfactory. So, further medical workshops are needed to teach the physicians about screening schedules and diabetic retinopathy [9].
"Diabetic patients' awareness of diabetic retinopathy symptoms and complications"	Aime: assess awareness of diabetic retinopathy symptoms and complications in the diabetic patient, cross-sectional study, in Saudi Arabia, 2019, questionnaire, 385 diabetic patients type one and two patients, age (15-75 years old)	conclusion was that there was an acceptable level of awareness and knowledge with the need to increase the level of this knowledge [10].

Conclusion:

Our investigation reveals a multifaceted picture of diabetic retinopathy management, characterized by a disconnect between patient awareness and engagement in crucial follow-up practices. While participants demonstrated knowledge of diabetic retinopathy as a sight-threatening condition, no statistically significant correlation was observed between educational level, stage of diabetic retinopathy, and adherence to regular eye examinations.

The primary factor influencing irregular retinal follow-up, however, emerged as a lack of awareness regarding its importance in protecting vision. This underscores the necessity for comprehensive educational programs targeted toward all education levels, tailored to effectively bridge the gap between knowledge and behavior change. Such programs should not only emphasize the potential consequences of neglecting regular examinations but also empower patients to navigate healthcare systems and prioritize eye health within their diabetic management regimes.

Furthermore, our analysis suggests the need for heightened awareness among physicians regarding early referral for all type 2 diabetes mellitus patients, regardless of disease duration. This recommendation aligns with evidence highlighting the potential gap in healthcare providers' knowledge and practices related to diabetic retinopathy education (Al-Khamis et al., 2022). Equipping physicians with the necessary skills and resources to effectively recognize early signs, educate their patients, and promptly refer suspected cases is crucial for timely intervention and improved visual outcomes.

Declaration

The work presented in this paper, titled " The Relation between Awareness of diabetic retinopathy and its Grade in Libyan Diabetic Patients", has not been submitted to any other journal for publication. All data collected for this research was kept confidential and informed consent was obtained in writing from all participants. I used the language model Bard from Google AI to review my language and enhance the academic tone of the manuscript.

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