Health Literacy Level of Patients with Diabetic Retinopathy: An Observational Descriptive Cross Sectional Study

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ABSTRACT
Background: Diabetic health literacy, encompassing knowledge, motivation, and the ability to access, understand, evaluate, and apply healthcare information, is a crucial non-clinical factor in diabetes management.
Objective: To evaluate the health literacy levels in diabetic patients and its impact on retinal health, including a complete epidemiological profile of the participants.
Subjects and Methods: This observational descriptive cross-sectional study included 500 Egyptian diabetic patients attending the Ophthalmology outpatient clinic at Al-Azhar University Hospitals from November 2022 to September 2023. Participants underwent a comprehensive evaluation including a specially designed questionnaire based on the European Health Literacy Survey (HLS-EU), thorough medical history, complete ophthalmological examination, fundus photography, and laboratory tests as needed.
Results: There was a statistically significant correlation between health literacy levels and education, BMI, treatment compliance, and the presence of retinopathy (p<0.05). Among the patients, 320 (64%) had no retinopathy. The percentage of patients with adequate health literacy (excellent and sufficient) was 44.6%, while 55.4% had inadequate health literacy (problematic and inadequate). In patients with diabetic retinopathy, only 22.8% had adequate health literacy. For those with severe diabetic retinopathy, the percentage dropped to 9.2%. Among patients without diabetic retinopathy, 57% had adequate health literacy, whereas 43% had inadequate levels.
Conclusion: Health literacy is significantly associated with diabetic retinopathy, treatment compliance, BMI, and education levels in diabetic patients.
Keywords: Health literacy level, Diabetic Retinopathy, Ophthalmology clinic, Cairo, Al-Azhar University, Egypt.

INTRODUCTION

Health literacy is crucial for effective self-care of chronic conditions and the maintenance of overall health. It plays a significant role in the healthcare system [1], as emphasized by the World Health Organization, which recommends health literacy as a tool to achieve several key health improvement targets [2].

Health literacy encompasses three basic levels: functional, interactive, and critical [3]. Lower levels of diabetic health literacy present a significant barrier to effective diabetes management, representing an important non-clinical factor [4]. The implications of health literacy extend to various aspects of the healthcare system, impacting patients, physicians, and healthcare organizations. It is essential for overall health and disease prognosis as it influences a person's ability to self-manage and make informed health-related decisions [5].

Low health literacy levels are associated with poor glycemic control, which in turn is linked to diabetic retinopathy [6]. Limited health literacy significantly contributes to the prevalence of eye diseases. Enhancing health literacy and conducting ophthalmological surveys can improve our understanding of the risk factors associated with chronic diabetic retinal disease [7].

The aim of this study was to assess the health literacy levels in diabetic patients and their impact on retinal health, along with a comprehensive epidemiological profile of the participants.

Subject and methods
Study Design and Setting

This observational descriptive cross-sectional study was conducted on 500 Egyptian diabetic patients who attended the Ophthalmology outpatient clinic at Al-Azhar University Hospitals from November 2022 to September 2023.

Inclusion and Exclusion Criteria

Inclusion criteria were diabetic patients aged 16-85 years who attended outpatient clinics at Al-Azhar University Hospitals. In contrast, exclusion criteria were patients with non-diabetic retinal diseases.

Study Procedures

A) Health Literacy Assessment: A specially designed questionnaire based on the European Health Literacy Survey (HLS-EU) was administered. The questionnaire consisted of 16 questions aimed at assessing the health literacy level of participants. The total score was 32. Patients were classified into two categories based on their health literacy scores: inadequate (includes problematic and inadequate) and adequate (includes sufficient and excellent).

B) Medical History: A comprehensive medical history was obtained from each patient.

C) Body Mass Index (BMI) Assessment: BMI was measured and recorded.

D) Ophthalmological Examination: Best corrected visual acuity was assessed using the Landolt chart. A slit-

lamp examination was performed to assess the anterior segment, measure intraocular pressure using a Goldmann Applanation Tonometer, and examine the fundus using a +90 D lens (slit-lamp biomicroscopy). Patients were classified as having a normal fundus or diabetic retinopathy according to the ETDRS study classification[8]:

Nonproliferative Diabetic Retinopathy (NPDR): This includes mild NPDR (presence of 1 microaneurysm), moderate NPDR (presence of microaneurysms, hard exudates, and hemorrhages), and severe NPDR (one or more of the following: hemorrhages and microaneurysms in 4 quadrants, venous beading in at least 2 quadrants, or Intra retinal microvascular abnormalities in at least 1 quadrant).

Proliferative Diabetic Retinopathy (PDR): This includes neovascularization either on or within one-disc diameter of the optic disc or elsewhere in the retina or rubeosis iridis. Low-risk PDR is characterized by the presence of new vessels that do not meet the criteria for high-risk PDR, whereas high-risk PDR is characterized by NVD that is one-third to one-half, or greater, of the disc diameter. All may be associated with clinically significant macular edema(CSME).

E) Investigations: Laboratory tests included fasting and postprandial blood sugar levels, Hemoglobin A1C, and urine analysis for microalbuminuria in some patients with macular edema. Fundus photography was performed for some patients with diabetic retinopathy using a Topcon XTRC fundus camera.

Ethical consideration:

The study obtained permission from the Ethical Committee at the Faculty of Medicine for Girls, Al-Azhar University. At the beginning of the interview, participants or the caregivers of participants who were than 18 years, received a comprehensive description of the study's objective and their informed verbal agreement was gained prior to their involvement. Absolute secrecy was assured for all participants. In accordance with the Declaration of Helsinki, individuals were also guaranteed the freedom to decline participation without any consequences on the treatment they got.

Statistical design

The data were evaluated using statistical approaches that involved calculating frequencies (the number of cases) and percentages for qualitative data and mean and standard deviation for quantitative data. The Chi-square (χ^2) test and *Fisher exact test* were used to compare groups regarding qualitative data. A two-sided p-value below 0.05 was deemed to indicate statistical significance. The statistical analyses were conducted using IBM SPSS (Statistical Package for the Social Sciences) version 22 for Microsoft Windows, developed by IBM Corp in Armonk, NY, USA.

RESULTS

A total of 500 participants were recruited for this study from the outpatient clinic of the Ophthalmology Department at Al-Azhar University Hospitals in Cairo. The socio-demographic distribution of the study population showed that the average age of participants was 54.9 years with a standard deviation of 12.2 years. Females comprised 61.8% of the participants, and 67.8% of them were from urban areas.

Level of health literacy of the studied population shows that the percentage of excellent health literacy were 25% ,(figure 1).
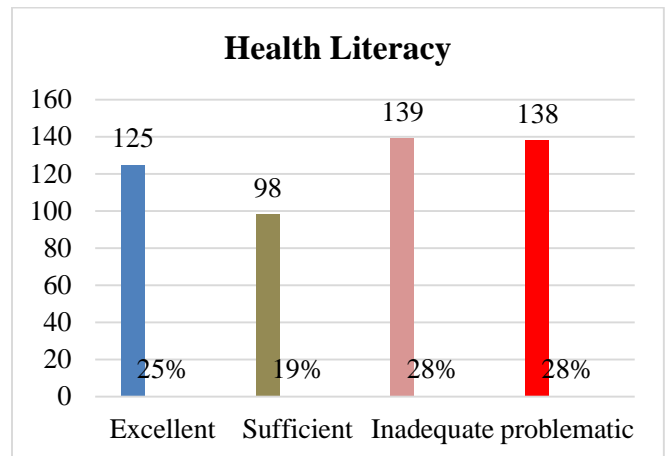

Figure 1: Distribution of health literacy levels of participants.

For patients with diabetic retinopathy **(Table 1)**, 22.8% had an adequate level of health literacy. Among those with severe diabetic retinopathy, only 9.2% had adequate health literacy. In contrast, 57% of patients without diabetic retinopathy had adequate health literacy, whereas 43% had inadequate levels.

Table 1: Distribution of various levels of health literacy of patients with retinopathy.

Total (180)	Health Literacy			
	Inadequate	Problematic	Sufficient	Excellent
Retino-pathy NO. (%)	(40%)	(37.2%)	(12.2%)	(10.6%)

There was a statistically significant correlation between health literacy levels and factors such as education, BMI, treatment compliance, and the presence of retinopathy. Among the patients, 64% did not have retinopathy. Excellent and sufficient health literacy was observed in 44.6% of the participants, while 55.4% had problematic or inadequate literacy levels. Illiterate individuals who had adequate health literacy (excellent and sufficient) were 20.3%.

33.1% of those who adhered to treatment, had an excellent level of health literacy, compared to 7.1% among non-adherent patients **(Table 2 and figure 2)**.

Table (2): Comparing health literacy and (educational level, compliance to treatment, BMI and Retinopathy) in the studied patients

Comparator (NO)		Health literacy				Test value	P value
		Inadequate %	Problematic %	Sufficient %	Excellent %		
Educational level	High	5.3	7	24.6	63.1	133.397(a)	0.001
	Illiterate	44.7	35	12.3	8		
	Read & write	16.2	25.3	25.8	32.7		
Compliance with treatment	Irregular	49.4	28.8	14.7	7.1	69.984 (a)	0.001
	Regular	18	27	21.9	33.1		
BMI	Normal	14.9	21.4	24.4	39.3	46.099 (a)	0.001
	Obese	38.5	26.9	9.6	25		
	Overweight	33.6	31.4	18.6	16.4		
Retinopathy	Advanced Eye disease	62.5	25	0	12.5	69.998 (a)	0.001
	CSME	40	30	30	0		
	High risk PDR	50	44.4	5.6	0		
	Low risk PDR	23.5	41.2	23.5	11.8		
	Mild NPDR	34.4	40.6	12.5	12.5		
	Moderate NPDR	48	30	10	12		
	No DR	20.9	22.2	23.8	33.1		
	Severe NPDR	30.7	46.2	7.7	15.4		

a: Have expected count less than 5, BMI: Body Mass Index, NPDR: Nonproliferative Diabetic Retinopathy, PDR: Proliferative Diabetic Retinopathy, CSME: Clinically Significant Macular Edema, DR: Diabetic Retinopathy.
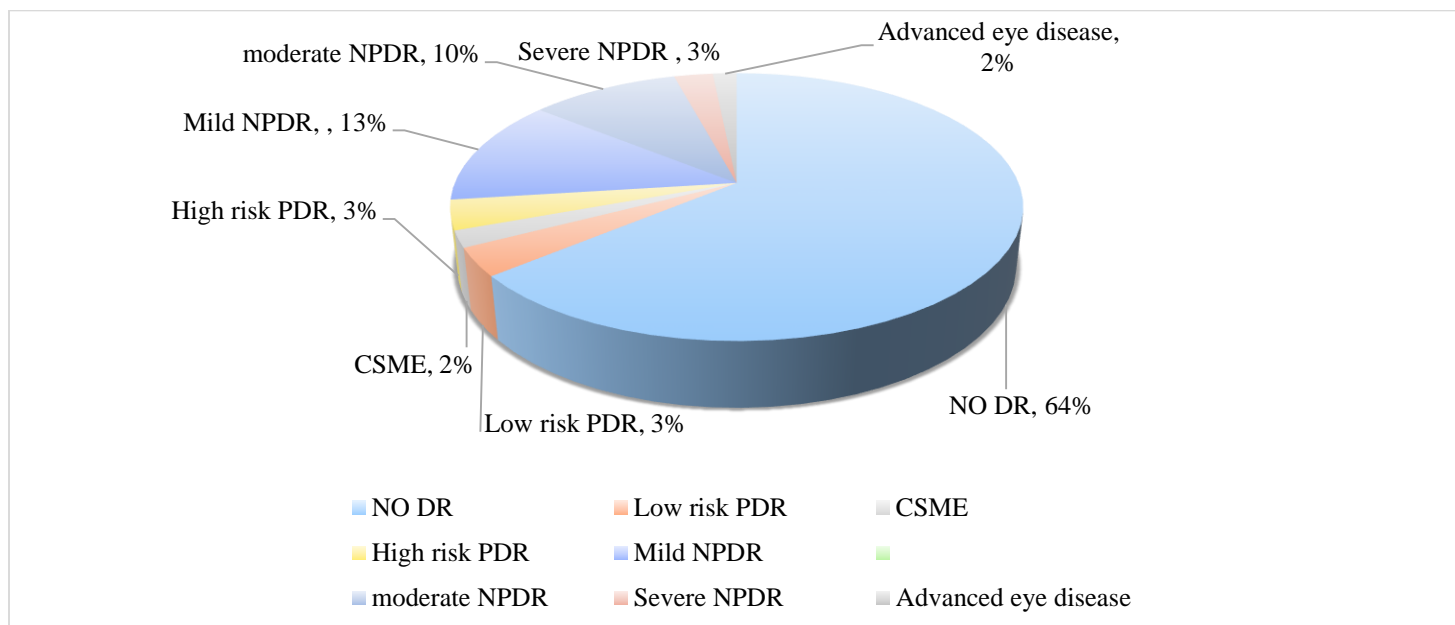

Figure 2: Distribution of retinopathy among participants.

NPDR: No-proliferative Diabetic Retinopathy, PDR: Proliferative Diabetic Retinopathy, CSME: Clinically Significant Macular Edema, DR: Diabetic Retinopathy.

Body mass index of the studied population shows that 56% were overweight and 11% were obese (figure 3).
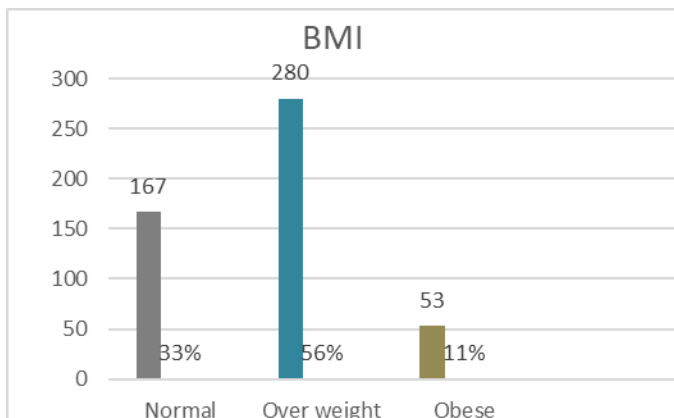
Figure 3: Distribution of BMI among participants.
BMI: Body Mass Index

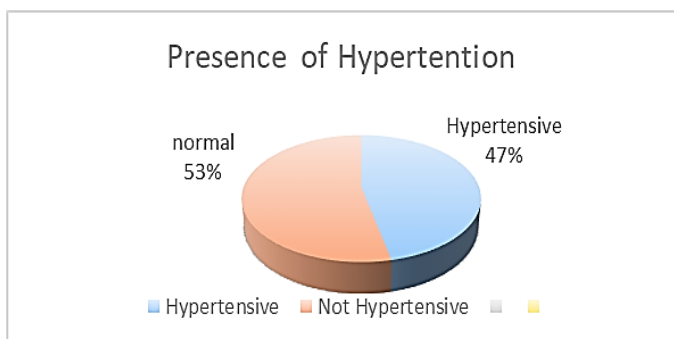The presence of hypertension between participants is illustrated in **Figure 4**.

Figure 4: Presence of hypertension between participants.

DISCUSSION

In the present study, the mean age of the patients was 54.9 years. Regarding health literacy, the overall adequate health literacy level in diabetic patients was 44.6%. This result is consistent with the study by **RobatSarpooshi et al.** [9], which found a rate of 44.1%. The adequate health literacy level in diabetic patients in the studies by **Mogessie et al.** [10] and **Baral et al.** [11] was 58.1% and 86.3%, respectively, which is higher than that in the present study. The result of the present study is higher than those of **Nair et al.** [12], **Ansari et al.** [13], and **Al-Sharit and Alhalal** [14], which were 11%, 33.8%, and 37.2%, respectively. They stated that patients' health literacy was related to age, gender, marital status, occupation, education level, socio-economic status, and place of residence.

Relation between Health Literacy and Diabetic Retinopathy

In the current study, for patients without diabetic retinopathy, the adequate health literacy level was 57%. Among the 36% of patients with diabetic retinopathy, the adequate health literacy level was 22.8%. This result is lower than that of **Schillinger et al.** [7], who found that 55% of their diabetic patients had retinopathy and 56% of them had an adequate level of health literacy. This

difference may be due to variations in education and socioeconomic status. In the present study, among patients with severe types of diabetic retinopathy, the adequate health literacy level was only 9.2%, compared with 16.7% in mild to moderate cases. This indicates that patients with diabetic retinopathy had worse health literacy levels than those without retinopathy. Additionally, patients with severe diabetic retinopathy had worse health literacy levels than those with mild to moderate retinopathy. The result of the present study agrees with **Schillinger et al.** [7], who noted that diabetic patients with inadequate health literacy were more likely to report retinopathy.

Relation between Compliance with Treatment and Health Literacy

In the current study, most patients (344, or 68.8%) were compliant with treatment, of which 55% had an adequate level of health literacy. Among the remaining 156 patients (31.2%) who were not adherent to treatment, the adequate health literacy rate was 22%. In a study by **Rocha et al.** [15], 87.2% of diabetic patients were adherent to treatment, with 48.7% having an adequate level of health literacy. **Faria et al.** [16] found that 84.2% of their diabetic patients were adherent to treatment. These studies are nearly consistent with the present study. **Ngoatle et al.** [17] found that 30.6% of their diabetic patients were adherent to treatment, which is lower than the present study's results. In a review of 27 studies by **Hyvert et al.** [18], it was confirmed that there was an unclear relationship between health literacy and medication adherence, although health literacy plays a substantial role in medication adherence.

Relation Between Education and Health Literacy

In the current study, the adequate health literacy level in educated and literate diabetic patients was 64.6%, while that of illiterate patients was 20.4%. Specifically, the adequate health literacy level in educated patients was 87.7%, while that of literate patients was 61.4%. This indicates that higher education levels correlate with higher overall adequate health literacy. This finding is in agreement with studies by **Mogessie et al.** [10], **Tefera et al.** [19], and **Xu et al.** [20], who found that higher educational attainment is associated with better diabetic health literacy. They suggested this might be due to better access to learning opportunities through courses and social media for those who attended college and universities.

Relation Between BMI and Health Literacy

In the current study, regarding BMI, 33.6% of patients had a normal BMI, with an adequate health literacy level of 63.7%. Among the 10.4% of patients who were obese, the adequate health literacy rate was 34.6%, and 56% of patients were overweight with an adequate health literacy rate of 35%. Patients with an adequate level of health literacy generally had a normal BMI and

vice versa. The results of the present study are nearly consistent with those of **Toçi** *et al.* [21], who studied the relation of BMI and health literacy levels in diabetic patients. They reported that 36.5% of patients had a normal BMI with an adequate health literacy rate of 69.3%, 41.3% were obese with an adequate health literacy rate of 54.1%, and 22.2% were overweight with an adequate health literacy rate of 47.8%. The present study's results agree with **Toçi** *et al.* [21], who noted a strong, consistent, and highly significant association between BMI and health literacy, indicating that the relationship between BMI and health literacy is strongly and inversely correlated, regardless of socio-demographic characteristics.

The study limitations include the cross-sectional design, which prevents establishing causality, the reliance on self-reported data for health literacy and treatment adherence, which may introduce response bias, and the single-center setting at Al-Azhar University Hospitals, which may limit the generalizability of the findings to other populations. Additionally, the study did not account for potential confounding factors such as socioeconomic status and comorbid conditions that could influence health literacy and diabetic retinopathy outcomes.

CONCLUSION

The study demonstrates a significant relationship between health literacy and various factors including diabetic retinopathy, treatment compliance, BMI, and education. Patients with diabetic retinopathy exhibited lower health literacy levels compared to those without the condition. Higher education levels were associated with improved overall health literacy. A strong and consistent relationship was found between BMI and health literacy, with higher health literacy levels correlating with lower BMI. Finally, good health literacy outcomes can reduce the risk of developing diabetic retinopathy.

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