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Effectiveness of retinopathy preventive guidelines on patients' knowledge, attitude, and practices among type II diabetics

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***Abstract*---**Background: Diabetic retinopathy is a serious complication of diabetes and is a major cause of visual impairment and blindness. Proper intervention and following preventive guidelines can prevent or halt the resulting vision loss. Aim: To evaluate the effectiveness of retinopathy preventive guidelines on patients' knowledge, attitude, and practices among type II diabetics. Design: A quasi-experimental design (pre-post and follow-up test) was applied to conduct this study. Setting: The study was conducted in diabetes clinics at the National Medical Institute Hospital in Damanhour. Subjects: A purposive sample of 200 patients with type 2 diabetes was collected. Tools: Two tools were used to collect the data; Tool (I) A structured interview questionnaire to evaluate the patient's demographic characteristics and clinical data. Tool (II) Patient's knowledge, attitudes, and practices regarding diabetic retinopathy questionnaire. Results: The current study clarified a significant improvement in the overall levels of Knowledge, Attitude, and Practices among diabetic patients post implementing preventive retinopathy guidelines and follow up phases compared to pre -preventive retinopathy guidelines implementation with p= (<0.001). In addition, there was a significant positive association between diabetes knowledge, practice, and attitude scores regarding retinopathy preventive guidelines with p-value= (<0.001). Finally, a significant positive correlation was found between patients' Knowledge, Attitude, and Practices in relation to diabetic retinopathy with demographic characteristics at p = (0.001). Conclusion: Implementation of diabetic retinopathy preventive guidelines revealed

a highly significant improvement in the overall level of knowledge, attitude, and practice regarding diabetic retinopathy prevention after preventive guidelines implementation. Recommendations: Efforts should be made to design and implement appropriate training programs and continuous education to expand patient education approaches for patients with type II diabetes to prevent diabetic retinopathy.

***Keywords*---**Retinopathy, Preventive Guidelines, Knowledge, Attitude, Practice, and Type II Diabetes.

Introduction

The World Health Organization confirmed the number of people at risk of Diabetes Mellitus (DM) increased from 108 million in 1980 to 422 million in 2014 (WHO 2020). The prevalence is expanding faster in lower-middle-income countries than in high-income countries. Diabetes is a serious public health problem worldwide. Diabetes causes many long-term complications and has a tremendous impact on patients, families, and society. This is because the disease disrupts individuals during their most productive times (Elshemy et al., 2018). DM will affect 642 Million adults by 2040, about 75% of whom live in low- and middle-income countries. However, diabetic retinopathy (DR) affects one in three patients with diabetes and remains the leading cause of blindness in adults (Wong & Sabanayagam, 2020).

DR is the most common microvascular complication in DM and remains the leading cause of visual impairment and blindness in these patients. However, research on the factors that lead to diabetic retinopathy is limited (Seid et al., 2021; Hosseini et al., 2021). Moreover, discovering barriers to income situations in different countries could accelerate the development of successful DR screening programs (Piyasena et al., 2019).

All Diabetic patients need regular retinal examination for early detection and treatment of diabetic retinopathy. Oddly enough, screening for retinopathy is done by fundus examination by an ophthalmologist or by color fundus photography using a conventional fundus camera (mydriatic or non-mydriatic) by a licensed ophthalmologist or ophthalmologist. (Rodriguez-Acuña et al., 2020, Padhy et al., 2019).

Prevention of DR requires appropriate screening and treatment of diabetes as well as assessment of patients' knowledge, attitudes, and practices (KAP). KAP is a quantitative method based on standardized questionnaires that facilitates the collection of qualitative and quantitative data. It helps uncover misconceptions or misunderstandings that can hamper performance and change attitudes, to close the large gap between what is said and what is done.(Riordan et al.,2020, Mohamed et al.2019) Early detection, appropriate treatment, and strict blood sugar control are the keys to halting the progression of diabetic retinopathy. (Ghoreishi et al., 2019, Said & Hamed 2021)

In recent years, the successful implementation of public health programs in developed countries is expected to improve and modify the status quo of public health practices, including risk factor management as well as screening and treatment of diabetic retinopathy. (Aly et al., 2021, Wong & Sabanayagam, 2019).Finally, strengthening facilitators is a key to advancing the challenges identified in DR (Egunsola et al., 2021, Ghoreishi et al., 2019).

Nurses play a vital role in the prevention and treatment of DR. One of the most important goals of nursing management of diabetics is to increase knowledge, improve attitude and practice, and prevent complications. It is clear that nurses can educate diabetic patients and encouraging them to actively participate in medical examinations (Al-Harbi et al., 2021, Safwat et al., 2018). Therefore, the aim of the current study was to evaluate the effectiveness of retinopathy prevention guidelines on patient knowledge, attitudes, and practices among patients with type II diabetes.

Significance of the study

Approximately 422 Million worldwide suffer from diabetes, and the prevalence of diabetes has been steadily increasing in recent decades. Regarding the incidence of DR according to the World Health Organization, Egypt ranked ninth among the top 10 countries in the Middle East and North Africa region (El-Kebbi et al., 2021, WHO 2020)

Although DR is the leading cause of blindness, it has harmful effects that can be prevented with early detection and treatment. DR screening may increase the number of cases treated early, especially in populations with limited access to care (Egunsola et al., 2021, Riordan et al., 2020). The success of a public health screening program for DR depends on the screening program's adherence to the eye care schedule. (Aly et.al; 2021).

In addition, emphasis should be placed on training medical staff and community nurses to examine and refer diabetic patients to eye centers, assist in providing information to diabetic patients, train medical and community staff, or conduct or facilitate continuing medical education to reduce the disease incidence and occurrence of associated blindness (Stojanović et al., 2018, Shetty & Swapnika 2017).

Aim of the Study:

The aim of the current study was to evaluate the effectiveness of retinopathy preventive guidelines on patients' knowledge, attitudes, and practices among type II diabetics.

Research Hypothesis:

H I. There would be improvement in the overall levels of KAP among diabetic patients post implementing preventive retinopathy guideline compared to pre - preventive retinopathy guidelines implementation.

Subjects and Method

Research Design

A quasi-experimental design using a one group (pre, post and follow-up) technique was used to conduct the current study. This design estimated the causal effect of the intervention (retinopathy preventive guidelines) on the dependent variables (patients' level of knowledge, attitudes, and practices).

Setting:
The current study was conducted at the diabetic clinics of Damanhour National Medical Institute Hospital, Damanhour City, Egypt.

Subjects:
A purposive sample of 200 type II diabetes patients (males and females).
Inclusion criteria: type diabetic patients with a history of diabetes for more than 1 year, without ocular complications aged 20-60 years who voluntarily agreed to participate in the study.
Exclusion criteria: patients who were diagnosed with DR, developed eye complications during the study and required special treatment and education, or patients who previously participated in any training program related to DR.

Sample size
The sample was calculated using Epi-info version 7. With an expected frequency of 60% and MOE of 5%, with a confidence level of 95%, the design effect was 1.5.The final sample size obtained for this study after rounding off was 200 studied patients.

Tools of data collection:
Two tools were used to collect data during the pre, post, and follow-up phasesafter revision of the relevant literaturesas the following:

Tool (I): The structured interview questionnaire:
This tool was developed by the researchers after reviewing the relevant literatures (Jani et al., 2020; Abel, et al., 2019; and Khalaf et al., 2019). It was included two parts asthe following:

Part (1) Patients' demographic data: it included 3 items regarding patients' personal data such as age, gender, and level of education.

Part (2) Patients' clinical data: it consisted of 4questions related to duration of DM, family history, blood glucose level, vision affection and main sources of information regarding DM.

Tool (II): Diabetic patient's knowledge, attitudes, and practices regarding DR assessment data:
It was adopted from (Khalaf et al., 2019, and Jani et al., 2020) and it was modified by the researchers after reviewing the relevant literatures (Thirunavukkarasu et al., 2021, Alharbi et al., 2021). It is written in plain Arabic and is used to assess a patient's KAP, and it consists of three parts as follows:

Part I: Patient's Knowledge Assessment Data:
This section consists of 11 (yes/no) questions about patients' knowledge related to DR. Correct answers had a score of 1 and incorrect scored 0 with possible total scores ranging from 0 to 11. Good knowledge accounts for more than 75% of the total score, 75% to 60% is considered average knowledge, and < 60% of the total score is poor knowledge.

Part II: Patient's Attitude Assessment Data:
This section includes 12 statements expressing patient attitudes regarding DR. The scoring system is a three-point Likert scale of (agree = 1), (unlikely = 2), and (disagree = 3) reversed points for negative statements. The total score for attitude is calculated by aggregating the responses of each respondent. An overall score of ≥ 3 is considered a positive attitude, while < 3 is considered a negative attitude.

Part III: Patient's Practices Assessment Data:
This section includes 8 (yes/no) questions related to eye care practices reported by diabetic patients. Correct answers had a score of 1 and an incorrect score of 0, good practice is counted if the total practice score is above 75%, 75% to 60% is considered average practice, and if < 60% of the total score is poor practice.

Validity and Reliability

Validation was performed by 5 experts in medical-surgical nursing and 2 consultant ophthalmologists. The reliability of the questionnaire on the KAP for patients was confirmed by Cronbach's alpha = 0.095 factor test.

Pilot study

A pilot study was conducted on 20 patients with type II diabetes (10% of the study sample) to test the clarity and applicability of the tool and the average time required to complete the questionnaire was evaluated. No changes were made to the research tools, so the experimental sample was added to the study sample.

Ethical Considerations

Ethical approval was obtained by the Institutional Review Board of the Faculty of Nursing, Damanhour University.Formal permission to conduct the study was obtained from hospital administrators. The aim and significance of the current research were explained for each patient. Patients are informed that they have the right to refuse to participate or withdraw from the study whenever they wish without any prejudice. Anonymity and confidentiality were assured by data coding. Moreover, patients were informed that these data would not be reused in another study without their permission. Finally, written informed consent was obtained from the patients who agreed to participate.

Procedures

The study was conducted through the following three phases: pre-implementing of the retinopathy Preventive Guidelines phase, the retinopathy prevention development and implementation phase, and post-implementing of the

retinopathy Preventive Guidelines phase. Data collection was conducted over a ten-month period from the beginning of January 2021 to the end of October 2021.

1- Pre-implementing of the retinopathy preventive guidelines phase:
Formal permission has been granted from appropriate official personnel, patients who met the inclusion criteria and agreed to participate in the study were individually interviewed to explain the nature and benefit of the current study and informed consent was then given. Each selected patient was invited to fill out a questionnaires using tools (I and II)to assess patient' demographic and clinical data and KAP regarding DR. Patients were tested for HbA1C. This phase continued until the number of patients required for the study was completed (200 patients).

2-Theretinopathy preventive guidelines development and the implementation phase:
The Preventive Guidelines were developed based on the identified needs and problems assessed in the previous phase and after reviewing the related literature (Hafe, 2021; Jani et al., 2020;Salahen et al.,2020; Patidar et al., 2019 and Khalaf et al., 2019).The Preventive Guidelines were developed over 3 sessions for each group (10 patients). Every session lasted approximately 30-45 minutes.

- The First session focused on improving patients' knowledge about DR definition, causes and risk factors, symptoms, prevention, when the patient should contact the doctor, complications of untreated DR, and methods for treatment.
- The Second session focused on improving patients' attitudes through explain the benefits of appropriate eye care,proper management, glycemic control,follow up, regular visits to ophthalmologists, periodical eye examinations, adhere to a medication schedule, adherence to proper nutrition, and appropriate physical activity.
- The Third session focused on improving patients' practice to prevent DR as measures to familiarize patients with barriers to retinopathy, improve patient intent to stay on track with care for their eyes including frequency of patient's follow-up, proper check for glucose level with a glucometer, proper fundus examination timetable, methods for achieving or maintaining a moderate weight with engagement in activity, following the doctor's recommended measures with antidiabetic medications, and lifestyle modifications.

The researchers present the material throughout these sessions in a straightforward manner using lectures, illustrative images, and videos for DR-related practical skills. Each session ends with researchers summarizing the key points and reviewing the session's content with time for patients' inquiries. Each patient received DR prevention self-care booklet including theoretical and practical session.

3-Post-implementing of the retinopathy preventive guidelines phase:
After each group completed the three sessions over three weeks, patients' KAP were reassessed using **tool II** immediately after implementation of the retinopathy

preventive guidelines. Reassessment for retention was carried out three months later (follow-up test) and blood glucose (HbA1C) test re-measured.

Data analysis

Data were collected, entered, analyzed, and tabulated. The data was analyzed using the IBM Statistics Package for the Social Sciences (SPSS) version 26. Qualitative data were assigned using percentages and numbers. The Kolmogorov-Smirnov test was utilized to check normal distribution. The chi-square test and categorical variable inference statistics were used to find significance. t-test was applied to the differences between the two means. The significance level was set at a p-value < 0.05, while the high level of significance was set at a p-value < 0.001.

Results

Table (1): showed that 59% of the studied patients were male, and 40% were in the age group of 40-<50 years. 34% of them graduated from secondary school, 61% had diabetes 10 years and more, 80% had a family history of diabetes, and the blood glucose level of 58% of them was controlled (HbA1C test), and 56% of them confirmed that their visual acuity is affected by diabetes.

Figure (1): revealed that 30% of studied patients had not received any information, in comparison, 26% of them confirmed that the doctor was the primary source of their information related to DM & DR followed by the nurse, internet/ social media, friends and relatives as sources(22%, 12%, 11%) respectively.

Table (2): showed a significant improvement in the mean scores of studied patients' knowledge, attitude & practice post implementing preventive retinopathy guidelines and follow up compared to pre preventive guidelines implementation with p= (<0.001).

Table (3): showed that there was a significant positive correlation was found between the phases of implementing retinopathypreventive guidelines: pre implementing phase, post implementing phase, and follow up- post implementation phasein terms of overall score of knowledge, attitudes, and practices for studied patients with p= (<0.001).

Table (4): revealed a highly statistically significant relationship between studied patients' knowledge, attitude, and practice regarding preventivemeasures of DR (p-value =<0.001).

Table (5): reflected a highly statistically significant positive relationship between knowledge of studied patients and their demographic and clinical data was found in the items of age, education level, and level of glycemic control at p = (0.001).While there is no correlation between the level of knowledge with gender, duration of DM, and family history of diabetes, and primary source of information regarding DM & DR.

Table (6): revealed a highly statistically significant positive relationship between attitude of studied patients and their demographic and clinical dataas found in the items of age, gender, educational level, family history of diabetes, duration of DM, and level of glycemic control at p = (0.001). While there is no correlation between the attitude and the duration of DM.

Table (7): illustrated a highly statistically significant positive relationship between practices of studied patients and their demographic and clinical was found in the items of age, gender, educational level, family history of diabetes, duration of DM, and level of glycemic control at p = (0.001). While there is no correlation between the practice and the duration of DM.

Table (1): Demographic characteristics and clinical data of the studied patients (N=200)

Variables	N	%
Age		
20-<30	38	19
30- < 40	62	31
40-< 50	80	40
50-60	20	10
Mean ± SD48.224±17.155		
Gender		
Female	82	41
Male	118	59
Level of education		
None educated	24	12
Primary school	36	18
Secondary School	68	34
Bachelor's degree	42	21
Higher education	30	15
Duration of DM		
< 5 years	50	25
5- < 10years	28	14
10 and more	122	61
Family history of DM		
Yes	160	80
No	40	20
Blood glucose level (HbC1A)		
Controlled	116	58
Uncontrolled	84	42
Is your vision is affected by DM?		
Yes	112	56
No	88	44

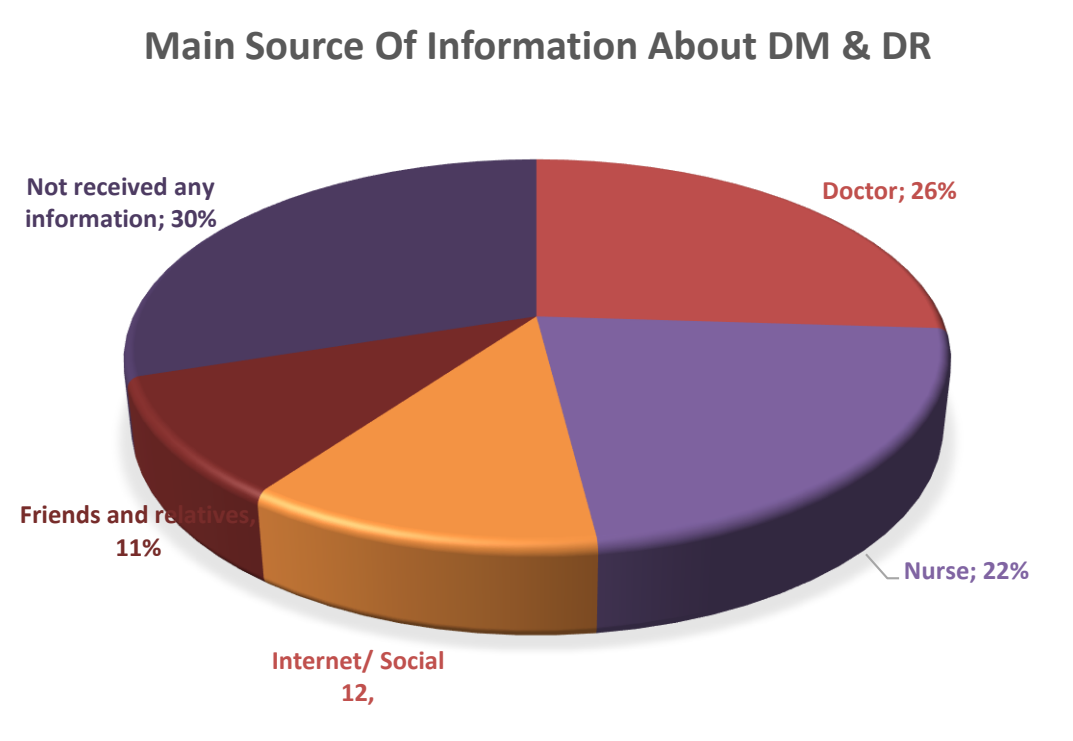

Figure (1): The percentage of the main source of information regarding DM and DR of studied patients

Table (2): Comparison between Knowledge Attitude, and Practice score levels in pre, post and follow-up of retinopathy preventive guidelines implementation among studied patients (N= 200)

Items		Test						P-value
		Pre		Post		Follow up		
		N	%	N	%	N	%	
Knowledge	Poor	78	39	4	2	12	6	<0.001*
	Average	84	42	40	20	76	38	
	Good	38	19	156	78	112	56	
Attitude	Negative	118	59	24	12	38	19	<0.001*
	Positive	82	41	176	88	162	81	
Practices	Poor	56	28	2	1	14	7	<0.001*
	Average	58	29	34	17	84	42	
	Good	86	43	164	182	102	5 1	

*Significant at P≤0.05

Table (3): Correlation between pre, post and follow-up preventive guidelines implementation phases regarding knowledge, Attitude, and practice among studied patients

Comp.	Knowledge		Attitude		Practices	
	T-test	P-value	T-test	P-value	T-test	P-value
Pre-Post	24.640	<0.001**	14.248	<0.001*	26.884	<0.001*
Pre-Follow up	22.642	<0.001**	22.822	<0.001*	24.678	<0.001*
Follow up-Post	13.892	<0.001**	11.860	<0.003*	22.482	<0.001*

*Significant at P≤0.05

Table (4): Correlation between Post implementing preventive guideline knowledge, attitudes, and practice among studied patients

Correlation		Knowledge	Practices
Practices	**P-value**	<0.001*	
Attitude	**P-value**	<0.002*	<0.001*

*Significant at P≤0.05

Table (5): Correlation between knowledge scores related to retinopathy preventive guidelines and demographic and clinical data among studied patients

Demographicand Clinical Data		N	Knowledge			F or T	ANOVA or T-test	
			Mean	±	SD		Test value	P-value
Age	20 - <30	38	15.156	±	6.183	F	63.474	<0.001*
	30 -<40	62	18.091	±	5.128			
	40 -<50	80	22.450	±	5.483			
	50 -60	20	27.913	±	4.862			
Gender	Female	82	23.389	±	6.160	T	9.949	0.454
	Male	118	20.308	±	7.096			
Level of education	None educated	24	24.848	±	6.690	F	52.977	<0.001*
	Primary school	36	14.744	±	6.377			
	Secondary School	68	25.143	±	4.988			
	Bachelor's degree	42	21.642	±	5.424			
	Higher education	30	13.800	±	2.260			
Duration of DM	<5 years	50	17.238	±	5.282	F	6.995	0.064
	5- < 10 years	28	23.667	±	5.951			
	10 and more	122	26.210	±	5.951			
Family history of DM	Yes	160	22.665	±	6.315	T	6.021	0.562
	No	40	17.145	±	7.447			
Blood glucose level (HbC1A)	Controlled	116	22.224	±	7.001	T	2.947	<0.001*
	Uncontrolled	84	19.322	±	5.770			

Table (6): Correlation between attitude score related to retinopathy preventive guidelines and demographic and clinical data among studied patients

Demographic and Clinical Data		N	Attitude			F or T	ANOVA or T-test	
			Mean	±	SD		Test value	P-value
Age	20 - <30	38	19.222	±	4.128	F	141.260	<0.001*
	30 -<40	62	24.318	±	3.583			
	40 -<50	80	28.767	±	4.727			
	50 -60	20	34.507	±	3.579			
Gender	Female	82	30.084	±	5.418	T	6.018	<0.001*
	Male	118	25.811	±	6.580			
Level of education	None educated	24	30.333	±	6.158	F	113.993	<0.001*
	Primary school	36	18.231	±	3.199			
	Secondary School	68	31.865	±	4.041			
	Bachelor's degree	42	27.552	±	4.290			
	Higher education	30	20.857	±	0.912			
Duration of DM	<5 years	50	29.828	±	4.962	F	46.738	0.312
	5- <10 years	28	33.173	±	4.873			
	10 years and more	122	22.556	±	4.090			
Family history of DM	Yes	160	28.816	±	5.498	T	6.952	<0.001*
	No	40	22.600	±	7.850			
Blood glucoses levels (HbC1A)	Controlled	116	28.577	±	6.215	T	5.084	<0.001*
	Uncontrolled	84	24.000	±	6.125			

Table (7): Correlation between practice score related to retinopathy preventive guidelines and demographic and clinical data among studied patients

Demographic and Clinical Data		N	Practices			F or T	ANOVA or T-test	
			Mean	±	SD		Test value	P-value
Age	20 - <30	38	14.178	±	3.242	F	59.44	<0.001*
	30 -<40	62	14.455	±	3.452			
	40 -<50	80	17.267	±	3.743			
	50 -60	20	21.290	±	3.163			
Gender	Female	82	18.206	±	3.766	T	3.949	<0.001*
	Male	118	16.260	±	4.579			
Level of education	None educated	24	30.333	±	6.158	F	52.977	<0.001*
	Primary school	36	18.231	±	3.199			
	Secondary School	68	31.865	±	4.041			
	Bachelor's degree	42	27.552	±	4.290			
	Higher education	30	20.857	±	0.912			
Duration of DM	<5 years	50	18.097	±	4.073	F	32.995	0.092
	5- <10 years	28	20.086	±	4.096			
	10 years and more	122	14.468	±	2.952			
Family history of DM	Yes	160	17.596	±	4.063	T	5.661	<0.001*
	No	40	14.945	±	4.912			
Blood glucose level (HbC1A)	Controlled	116	17.448	±	4.552	T	2.947	<0.001*
	Uncontrolled	84	15.729	±	3.028			

Discussion

Diabetic retinopathy is the most common microvascular complication of diabetes with damage to the retinal capillaries. It is the leading cause of blindness in adults worldwide. Diabetic retinopathy requires additional social and economic burdens by reducing productivity and quality of life. (Al-Harbi et al., 2021) Nurse practitioners have an invaluable role in patient education and can certainly help encourage patients to actively participate in screening. It is therefore important to engage with patients in improving their knowledge, attitudes, and practices for DR prevention (Safwat et al., 2018).

Regarding demographic characteristics and clinical relevant data, the current study findings was found that, more than half of studied patients were male, less than half were in the age bracket 40- <50, graduated from secondary school, they had diabetes for 10 years and more, and most of them had a family history of diabetes.These findings agreed with Abel et al., 2020 who reported that more than half of the patients were male, and most of them had a family history of diabetes, while he disagreed with our finding regarding the age group and stated that less than half were in the 50-60year-old. On the contrary, khalaf et al., 2019 confirmed that the majority of participants were female, the average age of the participants was 63.19±3.9, and most of them were illiterate.

Concerning the control of the blood glucose level of the studied patients, the results revealed that the blood glucose level of more than half of the studied patients was controlled (HbA1C test) post-implementing instructional guidelines. In comparison, in the pre-implementing phase, more than half of them were uncontrolled. This finding is consistent with Mosa et al., 2019 who found good glycemic control among diabetic patients.

Findings displayed that, third of the studied patients did not receive any information regarding DR while, more than a quarter of them confirmed that the doctor is the primary source of information related to DR, and more than half of them confirmed that their visual acuity is affected by diabetes. From the researchers' point of view, these results are due to the lack of health teaching methods and materials for all patients in hospitals and campaigns, despite the Egyptian Ministry of Health’s campaign for early detection and management of chronic diseases, of which diabetes is a major concern in this campaign. However, there were no brochures or educational materials available about DR and its consequences. This finding is not consistent with Bakkar et al.,2017;Alhargan et al.2019where they reported that the main source of information about DR in more than half of diabetic patients was doctors, followed by friends and family.Our finding is also in conflict with other studies Mersha et al., 2021and Al-Harbi et al., 2021 who reported that physicians and ophthalmologists were the most common sources of information about DR.

The result of the current study revealed a significant improvement in the mean scores of studied patients' KAP regarding preventive measures of DR in the post and follow-up prevention guidelines implementation phases compared to pre-prevention guidelines implementation phases. This result is in the same context as the study of Said &Hamed 2021, andSalahen et al., 2020 who emphasized a

satisfactory KAP score for DR prevention performance after the educational program, with statistically significant differences compared to the pre-implementation of the educational program. The present research finding agrees with that reported by Mohamed et al., 2019, who confirmed that the level of knowledge and attitudes of diabetics towards diabetes and DR changed positively in the short term after implementing an education program. This finding is supported by Safwat et al., 2018 who confirmed that the implementation of nursing guidelines had a positive impact on the level of knowledge regarding retinopathy patients.

Moreover, these results agree with Baiuomy et al. 2021 who illustrated that knowledge and practice of self-care significantly improved in diabetic patients who received the training program compared to those who did not. In addition, it can be compared with what Askari et al., 2018 demonstrated the benefit of a training program based on the BASNEF model on self-care attitudes for patients with type II diabetes which is very effective and useful in control, screening, and follow-up of blood glucose levels. Our findings are also supported by Salahin et al., 2020;Wong and Sabanayagam, 2019, and Kashim et al., 2018 demonstrated a significant improvement in patients' attitudes regarding eye examination after the implementation of a training program.

The present study finding showed a significance positive correlation between pre, post, and follow up phases among studied patients in terms of overall score of KAP. The result is consistent with the study finding by Raman, 2021, Salamanca et al., 2018, and Nizamani et al., 2017, who reported that there was a statistically significant relationship between pre-post implementation stages, pre-follow-up, and follow up- post implementation stages of the educational program regarding patient' level of KAP related to DR prevention.

The findings of the current study illustrated a highly statistically significant relationship between studied patientsknowledge, attitude, and practice regarding preventive measures of DR. There was also a statistically positive relationship between the overall practice scores of the studied patients and their attitudes. From the researcher's point of view, these results can be explained by the fact that patients' level of knowledge affects their practices, and the level of knowledge and level of practice can affect patients' attitudes. The study result agreed with Thirunavukkarasu et al., 2021, who confirmed that there is a high positive statistical relationship between the overall level of knowledge of the patients included in the study and their overall practices.

The researchers' study result also is consistent with Abel et al.,2021, Venugopal et al., 2020, Mohamed et al.,2019,andSrinivasan et al., 2017who reported good knowledge was significantly associated with positive attitudes and best practices toward DR prevention. Moreover, the present result agrees with Elshammaa et al, 2021 who reported a higher statistically significant relationship between knowledge, attitude, and practice.

The current study reflected a highly statistically significant correlation between knowledge of studied patients and their demographic and clinical data as found in the items of age, education level, and level of glycemic control. While there is no

correlation between the level of knowledge with gender, duration of DM, and family history of diabetes. This finding agrees with Aly et al., 2021, and Hafez, 2021 who showed that age was the main factor significantly associated with level of knowledge. This is also agreed with Mersha et al. 2021, and Neama et al. 2019 who demonstrated that the lack of patient knowledge regarding DR is related to education level and age. This result was also supported by Konstantinidis et al. 2017 who stated that patients' knowledge related to eye disease prevention showed no association between the duration of diabetes and gender.

The current research result contradicts Al-Harbi et al., 2021 who confirmed a level of knowledge is affected by gender but is not affected by age. Other researchers also illustrated a longer duration of diabetes was positively associated with good diabetic knowledge regarding diabetes (Assem et al., 2020,Gupta et al., 2018).Finally, other studies clarified that there is a statistically significant correlation between knowledge with gender, and duration of diabetes Al Zarea 2016, and Srinivasan et al., 2017.

The current research revealed a highly statistically significant positive relationship between the attitude and practice of studied patientswith their demographic and clinical data in the items of age, gender, education level, family history of diabetes, and level of glycemic control. While there is no correlation between the attitude and the duration of DM. From the researchers' point of view, there is always a significant positive effect of the level of education and age of patients on attitudes and practices, as younger patients take better care of their health than older ones, and a higher educational level is reflected in an increase in patient knowledge, which also leads to significantly improved patient attitudes and practices.

This finding is consistent with Elshammaa et al., 2022 who revealed a significant association between socio-demographic variables with attitude and practice. Hafez, 2021, and Aly et al., 2021 also found a statistically significant relationship between educational level and the level of attitude and practice. The positive effect of higher education on attitudes has been reported by Jani et al. 2020; Dinesh et al., 2020;Mosa et al., 2019;Falata 2018; Srinivasan et al., 2017;and Hussain et al., 2016. Furthermore, the relationship between younger ages and better attitudes and practices has been supported by Al-Zari 2016.

Conclusion

In light of the results of the current research, the research hypotheses were accepted. There were significant improvements observed in the overall level of knowledge, attitudes, and practice regarding DR prevention post implementation of the preventive guidelines compared to pre-preventive guidelines implementation.

Recommendations

- Efforts should be made to design and implement appropriate training programs and continuous education to expand patient education approaches for patients with type II diabetes to prevent DR.

- Educational program about diabetic retinopathy prevention measures should be provided in all health facilities.
- Arabic-colored illustrated booklets and leaflets on diabetic retinopathy prevention should be provided to diabetic patients in outpatient clinics.

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Conflict of interest
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