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EFFECT OF TYPE2 DIABETES ON EYE DISEASES (LENOPATHY, GLAUCOMA, RETINOPATHY AND OPTIC NEUROPATHY)

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Abstract: Awareness about diabetic eye complications and regular eye examinations plays an important role in avoiding blindness. Objective: To evaluate the level of awareness and knowledge about diabetic eye diseases among diabetic patients. Patients attending Ibn al-Haytham Teaching Hospital for Eye Diseases in Baghdad. Method: This is a cross-sectional study including a sample of 115 diabetic patients attending this center during the treatment period. The period is from 2023/8/15_2023/10/25. To achieve the objectives of the study, a closed study was conducted. A questionnaire that includes different variables related to diabetes awareness for each of them. The authors filled out the questionnaire during interviews with patients.

Keywords: -

Introduction

Diabetes mellitus (DM) is by far the most common metabolic disorder, its prevalence varying widely worldwide and ranging from as low as <1% to >30% (1). It is due to insulin deficiency or inefficiency, which results in a state of hyperglycemia (2). Insulin-dependent diabetes mellitus (TI DM) and non- insulin-dependent diabetes mellitus (Til DM) are the two

primary types and are the most widely distributed (1'3). In developing countries, the prevalence of diabetes is increasing, where there are, as 70 million people suffering from diabetes mellitus (4'5). DM affects human body from head to toes. This includes the eyes which is the one-inch spherical marvel that gives us vision. Damage to the eye is the most feared complication of diabetes and the most common and most serious eye complication of diabetes is diabetic retinopathy, which may result in poor vision or even blindness (6,7). DM is the most common cause of blindness of working-age (20-65 years). Although total blindness in diabetes is uncommon since just fewer than 2% of people with IDDM actually suffer total vision loss, however, the fear of losing one's sight is strong, as anyone with

diabetes who's had a change in vision can testify and unless an eye (7). Patients with diabetes are more likely to develop eye problems such as cataracts (clouding of the natural eye lens) and glaucoma [increased intraocular pressure (IOP)], but the disease's affect on the retina (diabetic retinopathy) is the main threat to vision (8). Most patients develop diabetic changes in the retina after approximately 20 years. Most people are unaware that they have eye damage; the great majority of this blindness can be prevented with proper examination and treatment by ophthalmologists (7'9'10). Thus, it is essential that every country attempts to assess the that every country attempts to assess the magnitude of the problem and takes steps to control and prevent eye complications in diabetic patients and provide appropriate care (11'12'13).

People living with diabetes are about 25 times more likely of becoming blind compared to the normal population (14). The incidence of vision loss or blindness due to ocular complications of diabetes rises (15). Some other known causes of blindness secondary to diabetes are cataracts, glaucoma, nerve palsies and macular degeneration (16). DM is a global epidemic and the prevalence is anticipated to continue to increase. The ocular complications of DM negatively impact the quality of life and carry an extremely high economic burden. While systemic control of blood glucose can slow the ocular complications, especially if clinical symptoms are already present. DM is further classified as type 1 (T1DM), which results from pancreatic beta cell failure such that insufficient insulin is produced to effectively clear blood glucose; type 2 (T2DM), which is defined by a state of insulin resistance whereby target cells fail to effectively respond to the hormone, insulin; and gestational DM, which occurs when pregnant women develop insulin resistance during pregnancy (17). Diabetic retinopathy (DR), microangiopathy affecting all of the small retinal vessels, such as arterioles, capillaries, and venules, is characterized by increased vascular permeability, ocular hemorrhages, lipid exudate, by vascular closure mediated by the development of new vessels on the retina and the posterior vitreous surface. In patients with type 1 and type 2 diabetics with disease duration of over twenty years, the prevalence's of diabetic retinopathy are 95% and 60%, respectively (18). Knowledge of the prevention and risk factors of ocular complications is essential to prevent vision loss among DM patients. Although the majority of diabetes patients are aware that diabetes can cause eye diseases, their attitude and practice are not at the desired level, which needs to be improved (19). The prevalence of diabetes mellitus is increasing, with an estimated 366 million people affected worldwide by 2030 according to the WHO, among which more than half will be presumed to be in Asian countries.

There are numerous studies on the prevalence and risk factors for DR, but very limited data exist regarding the awareness of diabetic eye problems (20).

Methods

A cross-sectional study was conducted on 115 samples of diabetic patients to follow the lessons of Ibn Al-Haytham Eye Hospital, Located in Baghdad_ Karrada is outside and These samples were distributed to a group of students and they participated in collecting these samples ، Data were collected and tabulated in the period from 15/8/2023 to 25/10/2023. (From 10 am to 2 pm) outpatient clinic interviews with them after obtaining their consent to participate in this study. The questionnaire was based on the knowledge and practice of patients with diabetes and

its possible ocular complications. The inclusion criteria were diabetic patients who suffer from visual impairment problems (lensopathy, optic neuropathy, retinopathy, and glaucoma، Blue wate) aged between 30 One year and above or less. While the exclusion criteria were patients with known hypertension, to avoid including the error, a patient with eye problems due to high blood pressure and not due to diabetes.

Data Collection: A specially designed questionnaire was used to collect information, which includes: demographic information; Age, gender, hemoglobin levels, RBC levels,
B- Clinical history. Diabetic type (Ior II), age of diagnosis, smoking history(If the patient smokes), history of previous eye trauma, history of previous eye diseases, previous medical history (meningitis, encephalitis, vitamin A deficiency) and history of other chronic diseases (meningitis, encephalitis, vitamin A deficiency Vitamin A) and other chronic diseases (hypertension and ischemic heart disease). C- Clinical eye examination. This is done at Ibn Al- Haytham Teaching Hospital for Eye Diseases by a specialized ophthalmologist. We check: visual acuity using the snellen E chart for use at a distance of 6 metres. Visual acuity less than 6/9 is considered affected. The pressure inside the eye is affected by measuring temperature.

Intraocular pressure by measuring the toe to detect glaucoma (IOP > 14 is considered high). The purpose of the study was explained as patient data were collected after obtaining verbal consent from the hospital

Result and Discussion

Results in table 1 showed that there is no so significant relationship between gender and age or eye diseases for diabetic's patients, but there are differences in frequencies between groups. This what will be explained in later sections.

Table 1. relationship between gender and eye diseases

Traits	Chi-sq
Gender x age	ns
Gender x lenopathy	ns
Gender x glaucoma	ns
Gender x retinopathy	ns
Gender x neuropathy	ns

Relationship between gender x age in prevalence of diabetes

Results in table 2 stated that there is no significant relationship between gender and age. For male and female, there is big difference in percentage between patients who are older than 30 and those are less than 30. This indicates the low frequency of diabetes among the younger categories, therefore, the number of diseases between them are less. The total sum of the final census among the sexes whose ages are older than 30 is 92.9%.

Table2. The relationship between gender and age on diabetics type2 frequency.

		Age	
		<=30	>30
Gender	Male	7.7%	92.3%
	Female	6.3%	93.8%
Total		7.1%	92.9%

Relationship between gender x lenopathy in prevalence of diabetes

Results of analysis by chi-seq stated there is no association between gender and lenopathy disease. We notice a difference in frequency as a percentage between gender and lenopathy, in males, where the percentage of infected people is 63.1%, and the percentage of healthy people is 36.9%. As for females, the percentage of infected people is 62.5% while in case of healthy people is 37.5%. The percentage among healthy people is 62.8%, and the percentage is the final percentage among those infected is 37.2.

Table3. The relationship between gender and lenopathy on diabetics type2 frequency.

		Age%	
		<=30	>30
Gender	Male%	63.1%	36.9%
	Female %	62.5%	37.5%
Total%		62.8%	37.2%

Relationship between gender x glaucoma

Results confirmed that there is no significant relationship between sex and glaucoma. In males, the number of affected people is 27, and the number of healthy people is 38. Likewise, the sex ratio is 41.5% in affected people, and in healthy people the percentage is 58.5%. For females, the number of infected people is 17, the number of healthy people is 31, and the total number between infected people and healthy people is 48. We notice an increase in the number of males compared to females, and the percentage of infected females is 35.4%, while the healthy female percentage is 64.6%. The total number of males and females among the infected is 44, whereas the total number among the healthy is

69. The percentage between the sexes among the infected is 38.9%, and the percentage among the healthy is 61.1%.

Table4. The relationship between gender and glaucoma on diabetics type2 frequency.

		Glaucoma	
		yes	no
	Males	41.5%	58.5%
	Females	35.4%	64.6%
Total		38.9%	61.1%

Relationship between age x retinopathy

Results in table 4 stated the percentages and numbers between ages and cases of retinopathy. In the case of greater than 30 years, the percentage of affected people is 25%, while the percentage of healthy people is 75%, this refers a little number of affected cases at this age. The ratio for those less than 30 age is 61.9% for infected and 38.1% for healthy people. The ratio between the two ages for the infected will be 59.3% and for the healthy it will be 40.7%. We notice a decrease in the number of infected people when their age is less than 30 years, and an increase in the number of infected people when their age is older than 31.

Table5. The relationship between gender and glaucoma on diabetics type2 frequency.

		Retinopathy	
		Yes	no
	>31	25.0%	75.0%
	<=30	61.9%	38.1%
Total		59.3%	40.7%

The relationship between age and eye diseases.

Show lenopathy and neuropathy with age high correlation at is significant ($p<0.01$, While as show glaucoma and retinopathy correlation at is significant ($p<0.05$) Relationship retinopathy with age refers to the changes in the retina, the light-sensitive tissue at the back of the eye, that occur as a person gets older. These changes can affect vision and eye health Glaucoma is related to age often due to high pressure in the eye. As people age, the risk of developing glaucoma increases

Table 6. relationship between age and eye diseases

Characters	Chi-sq
Age x lenopathy	0.000 **
Age x glaucoma	0.019*
Age x retinopathy	0.041 *
Age x neuropathy	0.003**

The relationship between age and lenopathy.

Results in table 6 indicated a significant relationship between age and lenopathy. There are no affected people in our sample at this age of more than 31 so the percentage between of healthy is 100%. In case when the age is less than 30 years, the number of infected people at this age will be 71 and the number of healthy people will be 34, the sex ratio will be 67.6% for the infected

and 32.4% for the healthy people. The ratio between the two ages for the infected will be 62.6% and for the healthy it will be 37.2%. We notice an decrease in the number of infected people when they are less than 30 years old, and a inecrease in the number of infected people when they are older than 31 years old.

Table 7. The relationship between age and lenopathy on diabetics type2 frequency.

Age * lenopathy					
			lenopathy		Total
			yes	no	
Age	>31	Count	0	8	
		% within age	0.0%	100.0%	
	<=30	Count	71	34	
		% within age	67.6%	32.4%	
Total		Count	71	42	
		% within age	62.8%	37.2%	

The relationship between age and retinopathy on diabetics type2

Results in table 5 indicated a significant relationship between age and retinopathy. Data in table 7 indicates the relationship between the sexes and retinopathy. In males, we notice an increase in the number of infected people compared to healthy people, the male gender ratio in infected people is 61.5%, while the percentage in healthy people is 38.5%. As for females, we also notice an increase in the number of infected people and a decrease in the number of healthy people, and the ratio between the sexes among healthy people is 56.3% among infected people and healthy people. The percentage is 43.8%. The final gender ratio for both males and females among those infected is 59.3%. The final gender ratio for both males and females in healthy people is 40.7%.

Table 8. The relationship between gender and retinopathy on diabetics type2 frequency.

gender * retinopathy					
			Diabetic retinopathy		Total
			yes	no	
gender	m	Count	40	25	65
		% within Gender	61.5%	38.5%	100.0 %
	f	Count	27	21	48
		% within Gender	56.3%	43.8%	100.0 %
Total		Count	67	46	113
		% within gender	59.3%	40.7%	100.0 %

Gender x neuropathy

Results confirmed that there is no significant relationship between sex and Diabetic neuropathy . In males, the number of affected people is 36, and the number of healthy people is 21. Likewise, the sex ratio is 55.4% in affected people, and in healthy people the percentage is 44.6%. For females, the number of infected people is 21, the number of healthy people is 27, and the total number between infected people and healthy people is 48. We notice an increase in the number of males compared to females, and the percentage of infected females is 43.8%, while the healthy female percentage is 56.8%. The total number of males and females among the infected is 57, whereas the total number among the healthy is 56. The percentage between the sexes among the infected is 50.4%, and the percentage among the healthy is 49.6%.

Table 9. The relationship between gender and neuropathy on diabetics type2 frequency.

gender * Diabetic neuropathy

			Diabetic neuropathy		
yes				no	Total
gender	m	Count	36	29	65
		% within gender	55.4%	44.6%	100.0%
	f	Count	21	27	48
		% within gender	43.8%	56.3%	100.0%
Total		Count	57	56	113
		% within gender	50.4%	49.6%	100.0%

Age x glaucoma

Results confirmed that there is no significant relationship between age and glaucoma. In, the number of affected people is 0, and the number of healthy people is 8. Likewise, the 31<ratio is 0% in affected people, and in healthy people the percentage is 100%. For f 30>, the number of infected people is 44, the number of healthy people is 61, and the total number between infected people and healthy people is 105. We notice an increase in the number of 30> age compared to 31<, and the percentage of infected 30> is 41.9%, while the healthy female percentage is 58.1%. The total number of 31< and 30< among the infected is 44, whereas the total number among the healthy is 56. The percentage between the ages among the infected is 38.9%, and the percentage among the healthy is 61.1%.

Table 10. The relationship between Age and glaucoma on diabetics type2 frequency.

age * glaucoma					
			glaucoma		Total
			Yes	no	
age	<31	Count	0	8	8
		% within age	0.0%	100.0 %	100.0 %
	>30	Count	44	61	105
		% within age	41.9%	58.1%	100.0 %
Total		Count	44	69	113
		% within age	38.9%	61.1%	100.0 %

The table below refers to patients with Lenopathy, an increase in the percentage of infected furniture, which is 69.0%, and the percentage decreases for males, as well as 31.0%.
- As for patients with glaucoma, we notice an increase in the percentage of those affected in females by 61.4% and healthy people by 52.2%, and a decrease in the percentage of those affected in males by 38.6% and healthy people by 47.8%.
-In Retinopathy we notice an increase in the percentage of those affected in females by 64.2% and a decrease in the percentage in males by 35.8%. As for healthy people, an increase in the percentage in males is 56.5% and a decrease in the percentage in females is 43.5%,
.Neuropathy: In patients with optic neuropathy, we note an increase in the percentage in females by 63.2% and a decrease in males by 36.8%, and an

increase in the number of healthy people in males by 51.8% and a decrease in females by 48.2%.
Table 11. The relationship between Age and glaucoma on diabetics type2 frequency.

Disease		Male	Female
Lenopathy	Yes	31.0%	69.0%
	No	66.7%	33.3%
glaucoma	Yes	38.6%	61.4%
	No	47.8%	52.2%
Diabetic retinopathy	Yes	35.8%	64.2%
	No	56.5%	43.5%
Diabetic neuropathy	Yes	36.8%	63.2%
	No	51.8%	48.2%

Relationship between age and glucose level, HB and RBCs.

In the following table. notice the relationship between the age of healthy people, the glucose level, the hemoglobin level, and the number of red blood cells.
We notice the effect of the glucose level in patients who are older than 31 years, their number is 8, the average normal value for them is 148.9, and the value of the standard deviation for them is 64.05, as well as the p-value. 005, which is a significant value, meaning there is a significant difference between the glucose levels of patients at this age.
In the case of patients whose age is younger than 30 years, their number is 105, the average normal value for them is 237.4, and the standard deviation value for them is 98.07, and the p-value is also 005, which is a significant value, meaning

there is a significant difference between the glucose level and patients whose age is younger than 30 years.
We also notice the hemoglobin relationship with patients whose age is older than 31 years, whose number is 8 and the average normal value for them is 13.6, and the value of the standard deviation for them is also 1.19695, and on this basis the p-value is. 526, which is a non-significant value, meaning there is no significant difference in hemoglobin
As for patients whose age is younger than 30 years, their number is 105, and the average normal value for them is 13.4, and the standard deviation value is 1.46052, and the p-value is also .562. It is also a non-significant value, meaning there is no significant difference between hemoglobin at this age.
In the case of red blood cells in patients older than 31 years, their count is 8, the average normal value is 5,603,750, and their standard deviation value is 942,700, and the p-value is. 004, which is a significant value, meaning there is a significant significant difference between the red blood cells of patients whose age is older than 31.
As for patients whose age is younger than 30 years, their number is 105, the average normal value for them is 4237428, and the standard deviation value for them is 817662, as well as the p-value. 004, which is a significant value, meaning there is a significant difference between the red blood cells of patients who are less than 30 years old.

Table 12. Relationship between age and glucose level, HB and RBCs.

	Age	N	Mean	Std. Deviation	P-value
Glucose level	>31	8	148.9	64.05	.005**
	<=30	105	237.4	98.07	
HB	>31	8	13.6	1.19695	.562 ns
	<=30	105	13.4	1.46052	
RBCs	>31	8	5603750	942700	.004**
	<=30	105	4237428	817662	

In the following figure, we notice the relationship between the sex of healthy people, glucose level, hemoglobin level, and number of red blood cells. The relationship between the sex of healthy people and the glucose level is the effect of the glucose level on the sex of males when their number is 65. Their average value is 2.356. The standard value is 107.3. We notice a p-value of 592, which is a non-significant value, meaning there is no significant difference between the male gender and the glucose level. As for the relationship between the glucose level and the female gender, whose number is 48, we notice a decrease in the numbers of females and an increase in

the numbers in the male gender. Where the average value for them is 225.2. Their standard deviation value is 85.9.
Also, the p-value 0 is not significant, meaning there is no significant difference between the glucose level and the sexes. As for the relationship between male gender and hemoglobin level, their number is 65, their average value is 14.0086, and their standard deviation value is 1.47456. The p-value is 0, meaning there is no significant difference between male gender and hemoglobin level. As for the relationship between female gender and hemoglobin level, when their numbers are... The average value for them is 13.6631. The standard deviation value is 95950. The p-value is also 0, meaning there is no significant difference between the genders.

s for the relationship between the sexes and the number of red blood cells. In terms of males, their numbers are 65. Also, their average value is 4453692. Also, the standard deviation value is 938180. The p-value is 004, which is a significant value, meaning there is a significant difference between the male gender and the number of red blood cells. As for the relationship between female gender and the number of red blood cells, their number is 48. Likewise, their average value is 4172291 and the standard deviation value is 813600. The p-value is 004, which is a significant value, meaning there is a significant difference between the sexes and the number of red blood cells.

Table13: The relationship between the incidence and absence of diabetes with the level of glucose, hemoglobin, and the number of red blood cells.

	Gender	N	Mean	Std. Deviation	P-value
Glucose level	Male	65	235.6	107.3	.562 ns
	Female	48	225.2	85.9	
HB	Male	65	14.0086	1.47456	.000**
	Female	48	12.6631	.95950	
RBCs	Male	65	4453692	938180	.004**
	Female	48	4172291	813600	

We note in the table above highly significant ,Increase (P < 0.01) in glucose levels in people with diabetes compared with healthy individuals and the other parameter RBCs highly decrease significant (P) in people with diabetes compared with healthy individuals on the ,other hand Hb displayed significant increase (p<0.05) in People with diabetes compared to healthy individuals We notice in the table above highly significant (p<0.01) in age and lenopathy in people with diabetes compared to healthy individuals, while glaucoma
and neuropathy appeared non significant in people with diabetes compared with healthy individuals on the other that retinopathy displayed significant (P
<0.05) in People with diabetes compared to healthy individuals .

Table 14: Relationship between Infection cases and glucose level, HB and RBCs.

	Case	N	Mean	Std. Deviation	P-value
Glucose level	Unaffected	50	169.69	67.57	.000**
	affected	63	280.03	91.95	
HB	Unaffected	50	13.13	1.32	.04*
	affected	63	13.67	1.49	
RBCs	Unaffected	50	4733800	904509	.000**
	affected	63	4016984	753671	

We note in the table above highly significant Increase ($P < 0.01$) in glucose levels in people with diabetes compared with healthy individuals and the other parameter RBCs highly decrease significant (P) in people with diabetes compared with healthy individuals on the other hand Hb displayed significant increase ($p<0.05$) in People with diabetes compared to healthy individuals

Recommendations

1- Health education programs should target older age groups and them providing more information about diabetic retinopathy.

2- The availability and accessibility of eye care services should increase and making eye clinic attendance more convenient for patients may increase the number of diabetics who have regular eye examinations.

3- General practitioners, physicians, and optometrists should make aware of the lack of knowledge about diabetic annual visual checking among diabetic patients, and should all involve in the planning and implementation of both hospital-based and community- based patient education strategies.

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