



A study of diabetic retinopathy in type 2 diabetic patients and its relation with diabetic progression

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Abstract

The study aimed to investigate the diabetic retinopathy in type 2 diabetic patients and its relation with the glycemic control represented with the glycosylated haemoglobin (HbA1c). The study performed in the diabetic and endocrinology center at Al-Sader medical city in Al-Najaf Al-Ashraf. The study included 102 subjects, divided into a (10) healthy subjects as control group and two groups of diabetic patients attended to the diabetic and endocrinology center at Al-Sader medical city and diagnosed as type 2 diabetic patients, divided into two groups with and without retinopathy. The type of retinopathy was determined by physicians, there are three retinopathy subtypes: diabetic retinopathy in early stages, proliferative retinopathy and macular edema. Most DR patients were in early stages of retinopathy 37.25%, proliferative diabetic retinopathy 11.76%, and macular edema 11.76%. The results show a significant increase of diabetic retinopathy DR prevalence with increasing diabetic duration, the incidence of DR was highest in patients of 15-20 years of diabetes mellitus, and the highest were the proliferative, then macular edema 12.33 ± 18.6 and 14.16 ± 2.32 respectively. The level of fasting plasma glucose among control, DM and DR groups increased significantly ($P < 0.05$), while there was no significant differences ($P < 0.05$) in FPG levels between these subtypes of DR.

The HbA1c was significantly highest ($P < 0.05$) in DM and DR ($6.65\% \pm 0.29$ and 8.025 ± 0.19 respectively) when compared with $5.73\% \pm 0.18$ in the control group. According to the successive HbA1c percentiles, the early stages of DR were found in all levels of HbA1c, but the highest incidence were in the highest levels. Also proliferative DR begin to appear at 7-7.5% of HbA1c, and its highest incidence were at 7.5 – 8%. Macular edema increased at 7-7.5% and at levels highest than 10.5%. There was a significant decrease in body mass index BMI in DR patients when compared with other groups, and a significant decrease in BMI in proliferative DR and macular edema when compared with the control.

The study concluded that there is a critical need to perform a periodical check to diabetic patients to diagnose the retinopathy in its early appearance, and to use the glycosylated haemoglobin as measurement periodically to detect any increase or fluctuation in this parameter to control the glycemic state in these patients.

Introduction

Diabetic Retinopathy (DR) is a chronic progressive, potentially sight-threatening a microvascular complication of diabetes mellitus, it is a retinal vascular disorder and is characterised by signs of retinal ischemia and/or signs of increased retinal vascular permeability, associated with the prolonged hyperglycaemia and other conditions linked to [diabetes mellitus](#) (DM) such as hypertension.(1) Progression of retinopathy is associated with the severity and length of time that [hyperglycaemia](#) exists(2) If diabetes is diagnosed before the age of 30, the incidence of DR after 10 years is 50%, rising to 90% after 30 years. There is no set glycaemic threshold that will predict the presence or otherwise of diabetic retinopathy(3). [Hypertension](#) and other [cardiovascular risk](#) factors can influence the onset and progression of retinopathy. There is marked individual variation in susceptibility to retinopathy for a given vascular risk



profile(4). The two broad categories of DR are nonproliferative diabetic retinopathy NPDR and proliferative diabetic retinopathy PDR. Nonproliferative diabetic retinopathy is characterized by retinal Micro aneurysms (Ma), intra retinal hemorrhages (blot, dot, or flame), hard exudates, soft exudates (cotton wool spots), venous looping, and/or venous beading. (5). The most severe form of DR is PDR. Most patients with PDR are at significant risk for vision loss. Characteristics of the disease include new vessels on or within one disc diameter of the optic disc or new vessels elsewhere in the retina outside the disc and one disc diameter from disc margin, fibrous proliferation on or within one disc diameter of the optic disc or elsewhere on the retina and/or vitreous hemorrhage (VH). PDR that has not reached the high-risk level has a 75 percent likelihood of becoming high risk within a 5-year period(6).

Macular Edema (ME) defined as the collection of intraretinal fluid in the macular area of the retina, with or without lipid exudates or cystoid changes, ME can occur at any stage of retinopathy. When macular edema involves or threatens the center of the macula, it is considered "clinically significant." Whether present in NPDR or PDR, this edema results from Ma or other focal or diffuse vascular leakage within or near the macula. Visual acuity is generally compromised when the ME affects the fovea(7).

The aim of study is investigating the diabetic retinopathy in type 2 diabetic patients and its relation with the glycemic control represented with the glycated haemoglobin (HbA1c).

Patients and Methods

The study was conducted between July 2013- September 2013 and it was carried out at Al-Sader medical city in Al-Najaf Al-Ashraf province/Iraq . The study included (102) subjects (46 males, 56 females), 10 healthy subjects as control group, and 92 patients attended to Al-Sader medical city in Al-Najaf Al-Ashraf, divided into 2 groups: (30) type 2 diabetic patients; (62) diabetic patients with retinopathy (34 males, 28 females). The first group of patients was the type 2 diabetic patients who were attended to the diabetic and endocrinology center, and registered in the center as type 2 diabetic mellitus patients, (DM) group. The second group of patients was the retinopathy patients who were attended to the diabetic and endocrinology center, and registered in the center as type 2 diabetic mellitus patients, and according to our request they selected by physician as possibly having DR and send to Ophthalmology unit and there diagnosed by physicians as DR patients based on history, clinical presentation, indirect ophthalmoscopy by volklense, Optical coherence tomography (OCT), fundus camera. All patients and control subjects aged 35-75 years. All subjects in this study were taken consent them before doing the examinations to them. We excluded patients with hepatitis, renal failure, liver disease, malignant disease and patients on chemotherapy, based on clinical and laboratory investigations. Also, smokers and alcoholic patients were excluded. A questionnaire of each patient was taken, it included: age, duration of diabetes mellitus, types of antidiabetic treatment, length, weight, blood pressure and family history of diabetes.

Glycosylated hemoglobin kit is used for quantitative colorimetric determination of glycohemoglobin in whole blood and was supplied by Stanbio laboratory (USA) according to the method presented by Trivelliet *al.*, 1971(8). Serum glucose level was measured by glucose (Glucose-PAP) kit (AUDIT DIAGNOSTICS, Ireland) which was based on the principle of Trinder, 1969(9).

The analyses were performed using the statistical package for social sciences (SPSS version 14.0). The data expressed as mean \pm S.E. , statistical significance was assessed by ANOVA, P values of less (0.05) was considered significant.



Results

Figure (1) shows the percentage of diabetic retinopathy types in diabetic patients of the study. Most DR patients were in early stages of retinopathy 37.25%, proliferative diabetic retinopathy 11.76%, and macular edema 11.76%.

Figure (2) reveals the incidence of DR in diabetic patients at different age ranges. Most DR patients were 50-55 years, and 55-60 years, and in elderly more than 70 years. The incidence of DR subtypes revealed in the figure (3), early stage of DR found in all age ranges, proliferative DR increased with increased age, also the highest percentage of macular edema were in elderly more than 70 years.

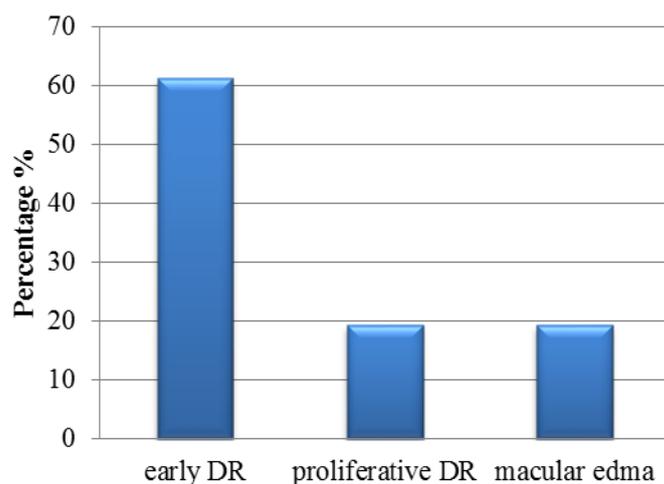


Figure (1): percentage of diabetic retinopathy types in diabetic patients of the study

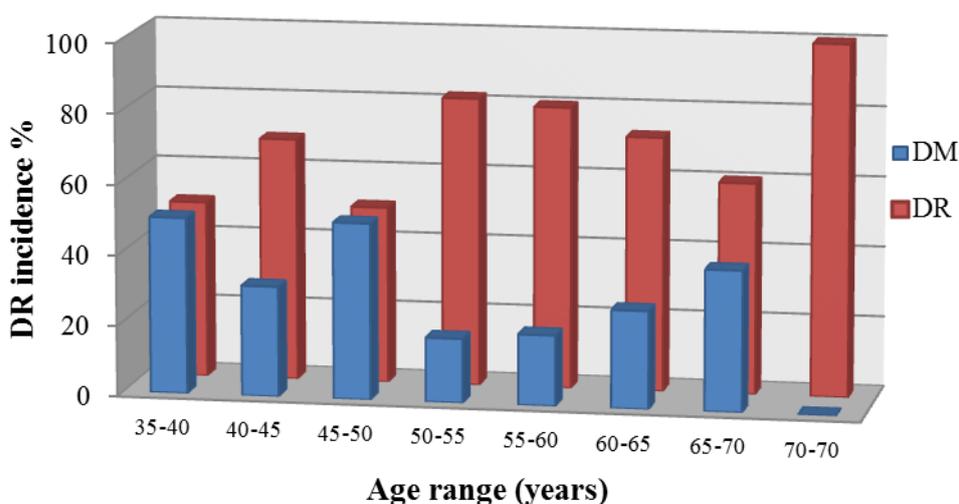


Figure (2): DR incidence in diabetic patients in different age ranges.

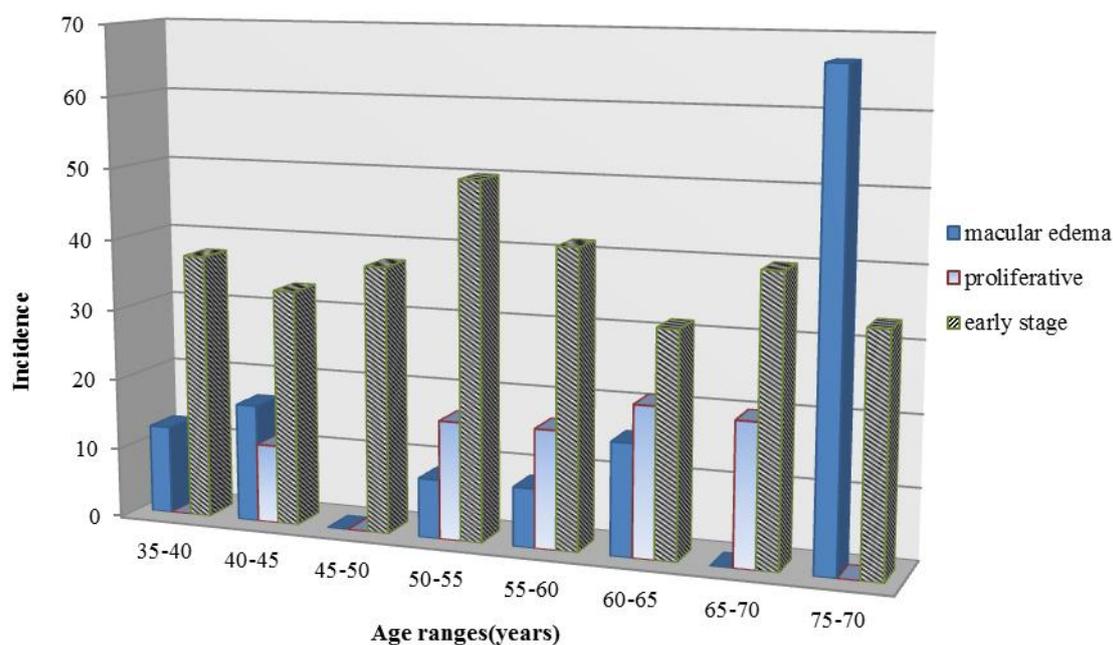


Figure (3): incidence of diabetic retinopathy in different age ranges

The incidence of DR was highest in patients of 15-20 years of diabetes mellitus, as shown in figure (4). In figure (5) the average of DM duration in different subtypes of DR, the highest were the proliferative, then macular edema 12.33 ± 1.6 and 14.16 ± 2.32 respectively. Figure (6) compare the level of fasting plasma glucose among control, DM and DR groups, both DM and DR increased significantly ($P < 0.05$), while figure (7) compare FPG levels in different subtypes of DR, there was no significant differences ($P < 0.05$) in FPG levels between these subtypes.

The HbA1c was significantly highest ($P < 0.05$) in DM and DR ($6.65\% \pm 0.29$ and 8.025 ± 0.19 respectively) when compared with $5.73\% \pm 0.18$ in the control group. Also there was a significant difference ($P < 0.05$) between DM and DR groups, (figure, 8). In the figure (9), no significant differences ($P < 0.05$) in HbA1c percentage in the comparison that made among the three types of DR.

The figure (10) shows the distribution of control subjects and patients with different DR subtypes in successive HbA1c percentiles. The early stages of DR were found in all levels of HbA1c, but the highest incidence were in the highest levels. Also proliferative DR begin to appear at 7-7.5 % of HbA1c, and its highest incidence were at 7.5 – 8 %. Macular edema increased at 7-7.5% and at levels highest than 10.5 %.

Figure (11) shows a significant decrease in BMI in DR patients when compared with other groups, and figure (12) shows a significant decrease ($P < 0.05$) in proliferative DR and macular edema when compared with the control.

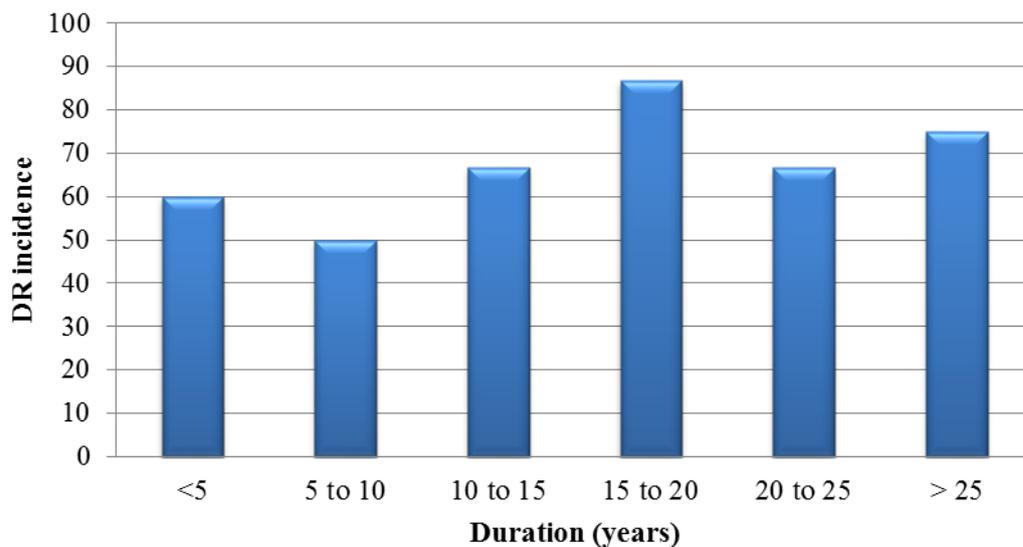


Figure (4): DR incidence in diabetic patients according to the duration of DM

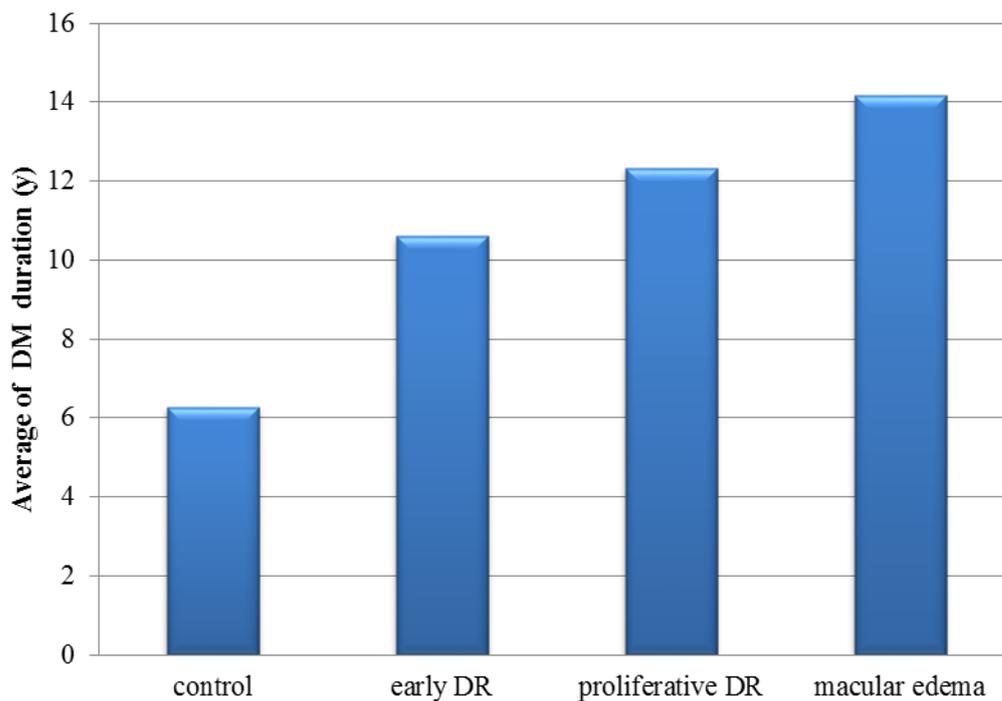


Figure (5): average of DM duration (years) in diabetic patients :control (without DR), with early DR, proliferative DR, and macular edema

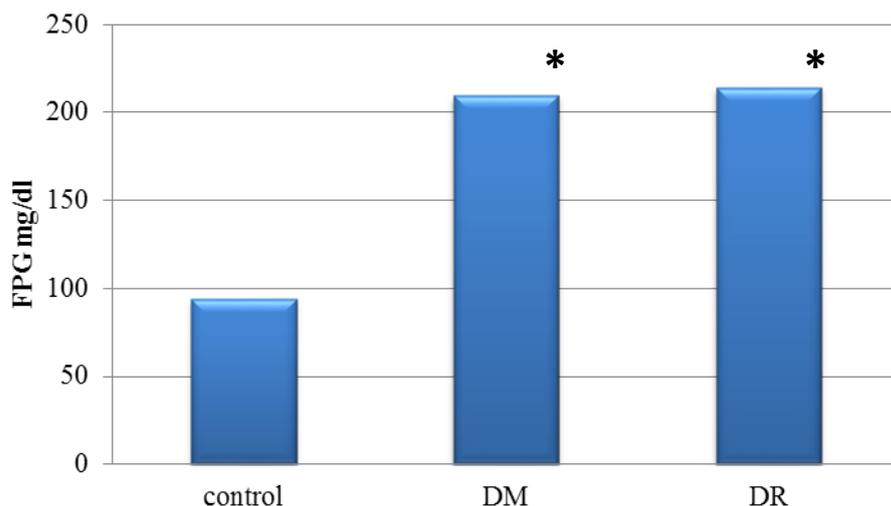


Figure (6): fasting plasma glucose (mg/dl) in control subject, diabetic patients (DM), diabetic patients with retinopathy(DR)

* Significant differences ($P < 0.05$) with control

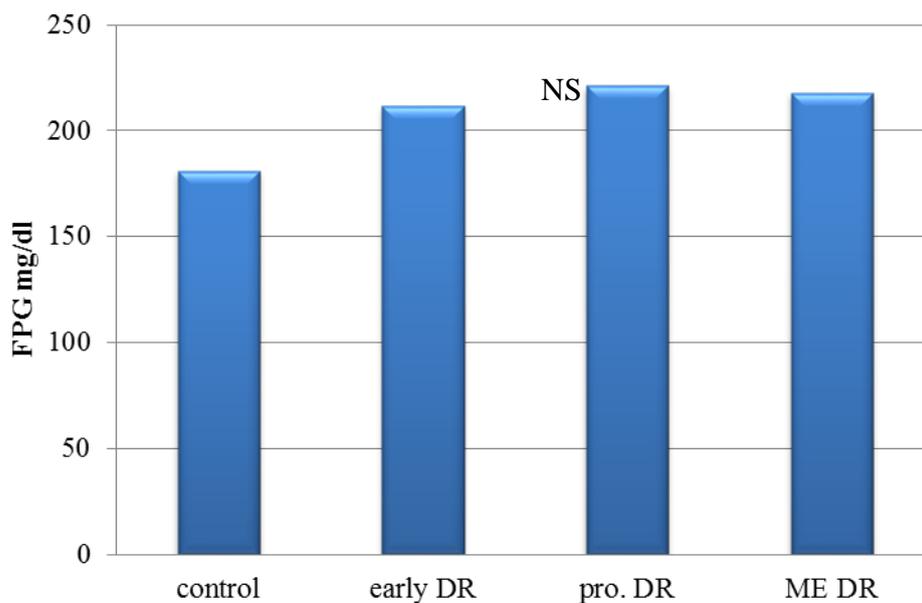


Figure (7): fasting plasma glucose (mg/dl) in control in control subjects, diabetic patients with early stage DR, proliferative DR, macular edema (ME)

NS: not significant differences ($P < 0.05$)

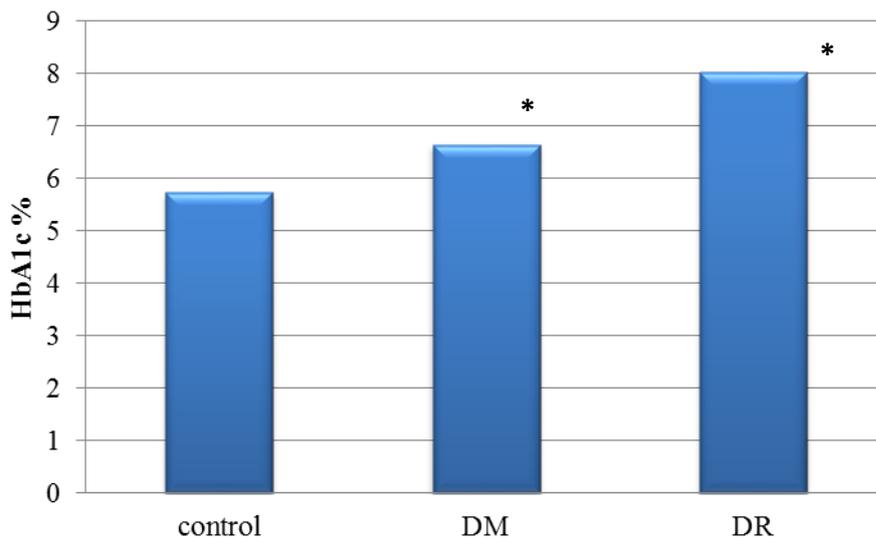


Figure (8): percentage of HbA1c in control subjects, diabetic patients(DM), and diabetic patients with retinopathy(DR)

*: There were a significant differences ($P < 0.05$) with control and between groups

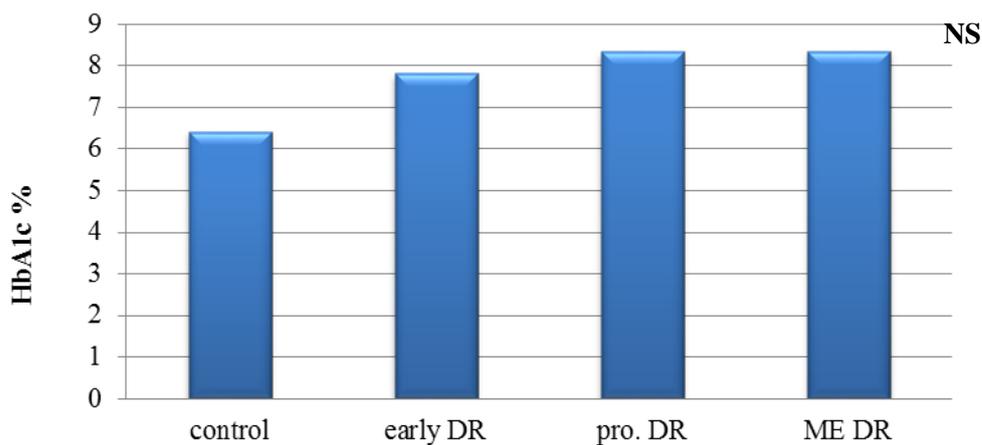


Figure (9): HbA1c percentage in control subjects, diabetic patients with early stage DR, proliferative DR, macular edema (ME)

NS: Not significant differences ($P < 0.05$)

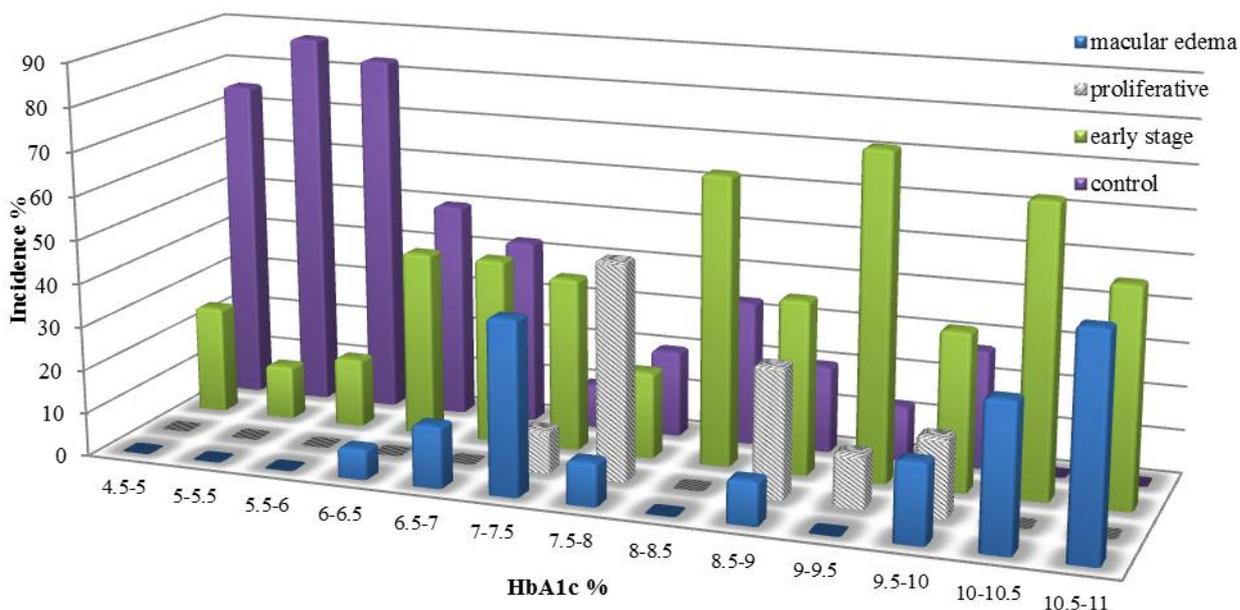


Figure (10): incidence of diabetes without DR (control), early DR, proliferative DR, and macular edema with increasing HbA1c percentage

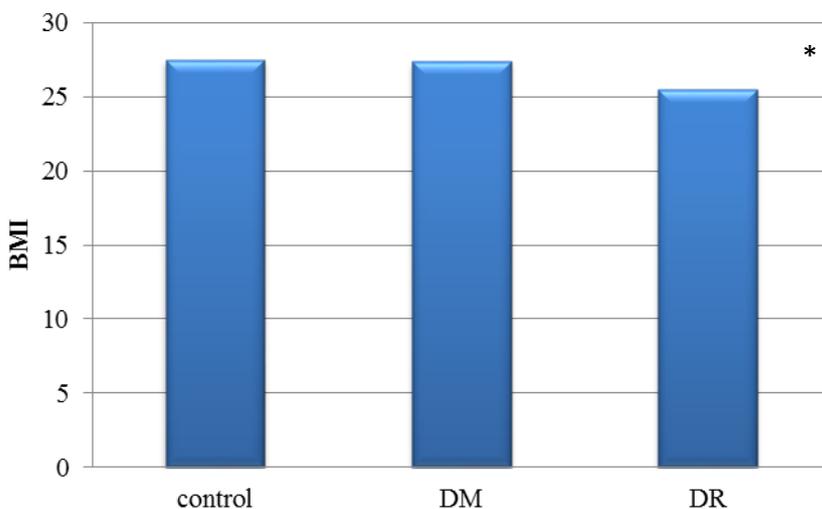


Figure (11): BMI in control subject, diabetic patients (DM), diabetic patients with retinopathy(DR)

*: Significant difference (P<0.05)DR and other groups

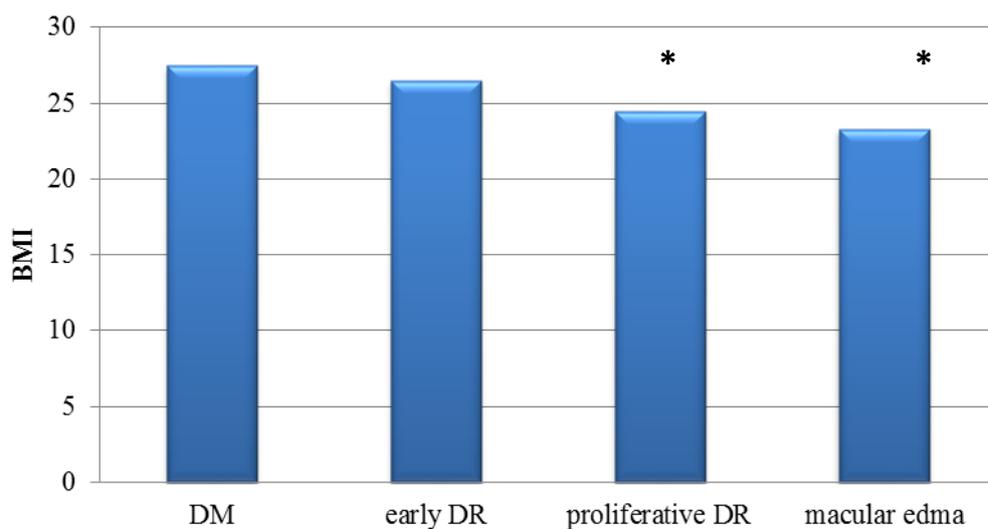


Figure (12): BMI in diabetic patients without DR (control), early DR, proliferative DR, and macular edema with increasing HbA1c percentage

*: Significant difference $P < 0.05$ with control group

Discussion

The study performed on diabetic patients who were attended to the diabetic and endocrinology center, and registered in the center as type 2 diabetic mellitus patients. The detection of DR performed according to our request. From 92 DM patients, a sum of 62 patients diagnosed as having DR. Diabetic retinopathy (DR) is a common chronic microvascular diabetic complication, and it is the leading cause of visual impairment among working adults in the Western world (Kempen *et al* ,2004). Apart from visual morbidity, the presence of DR may indicate microcirculatory dysfunction in other organs systems (10;11)

Most DR patients were in early stages of retinopathy 37.25%, proliferative diabetic retinopathy 11.76%, and macular edema 11.76%. This result indicates that most patients were unaware of their visual impairment. Also this result emphasizes the need to perform a periodically ophthalmic check. Figure (4) reveals the incidence of DR in diabetic patients at different age ranges. Most DR patients were 50-55 years, and 55-60 years, and in elderly more than 70 years. The incidence of DR subtypes revealed in the figure (5), early stage of DR found in all age ranges, proliferative DR increased with increased age, also the highest percentage of macular edema were in elderly more than 70 years. These results agreed with (12) who found that the incidence of DR increased with age. The incidence of DR was highest in patients of 15-20 years of diabetes mellitus, figure (6). In figure (7) the average of DM duration in different subtypes of DR, the highest were the proliferative, then macular edema. These results agreed with (13) who consider the duration of DM as a predictor for DR.

The level of fasting plasma glucose in DM and DR increased significantly, while there was no significant differences $P < 0.05$ in FPG levels between DR subtypes. The HbA1c was significantly highest ($P < 0.05$) in DM and DR ($6.65\% \pm 0.29$ and 8.025 ± 0.19 respectively) when compared with $5.73\% \pm 0.18$ in the control group. Also there was a significant difference ($P < 0.05$) between DM and DR groups, (figure, 10). In the figure (11), no significant differences $P < 0.05$ in HbA1c percentage in the comparison that made among the three types of DR. The figure (12) shows the distribution of control subjects and patients with different DR subtypes in successive HbA1c percentiles.



The early stages of DR were found in all levels of HbA1c, but the highest incidence were in the highest levels. Also proliferative DR begin to appear at 7-7.5 % of HbA1c, and its highest incidence were at 7.5 – 8 %. Macular edema increased at 7-7.5% and at levels highest than 10.5 %. Studies have shown that HbA1c was a pivotal risk factor for DR in patients with diabetes. Studies have shown that HbA1c was a pivotal risk factor for DR in patients with diabetes (14;15;16;17). There are several advantages to HbA1C as a diagnostic criterion for diabetes. HbA1C is less affected by short-term lifestyle changes, and its measurement has been improved and standardized during the last decade. (18) in their study determined a cut point for HbA1c, they found that the steepest increase in retinopathy prevalence occurs among individuals with HbA1c >5.5% and FPG >5.8 mmol/l. HbA1c discriminates prevalence of retinopathy better than FPG. Figure (13) shows a significant decrease in BMI in DR patients when compared with other groups, and figure (14) shows a significant decrease in proliferative DR and macular edema when compared with the control. This result agreed with (13) they found that The patients with DR had lower BMI. The study concluded that there is a critical need to order a periodical check to diabetic patients to diagnose the retinopathy in its early appearance, and to use the glycosylated haemoglobin as measurement periodically to detect any increase or fluctuation in this parameter to control the glycemic state in these patients.

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