International Journal of Medical and Pharmaceutical Research
Website: https://ijmpr.in/ | Print ISSN: 2958-3675 | Online ISSN: 2958-3683
NLM ID: 9918523075206676
Volume: 4 Issue:3 (May-June 2023); Page No: 890-892

Original Article

IJMPR

Serum Levels of Vitamin D in Patients of Diabetic Retinopathy at a Tertiary Level in North India

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ABSTRACT

Introduction: Diabetic retinopathy is a major complication of diabetes mellitus that can result in retinal vascular abnormalities and severe visual impairment. Vitamin D deficiency is involved in impaired glucose tolerance or type-2 diabetes. Vitamin D may affect the pathogenesis of diabetic retinopathy via its effects on angiogenesis by changing the presence of hypoxia inducible products, such as vascular endothelial growth factor.
Study design: It was cross-sectional study done at a tertiary centre in North India.
Results: In the Non proliferative diabetic retinopathy, proliferative diabetic retinopathy, diabetics without retinopathy and healthy controls mean serum vitamin D levels were 22.36 ± 4.90 ng/ml, 21.03 ± 6.21ng/ml, 26.44 ± 4.98 mg/dl 35.80 ± 5.20 ng/ml respectively.
Conclusion: The serum vitamin D levels were lower in Type 2 diabetic patients as compared to Healthy controls. The serum vitamin D levels were lower in diabetic patients with retinopathy as compared to diabetic patients without retinopathy. The serum vitamin D levels were slightly lower in Proliferative diabetic retinopathy patients as compared to Non proliferative diabetic retinopathy patients.

Key Words: *Diabetic retinopathy, vitamin D, angiogenesis, vascular endothelial growth factor*

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INTRODUCTION

In recent years, the prevalence of diabetes has increased rapidly globally, with an estimated 451 million people living with diabetes worldwide in 2017 and it is expected to increase to 693 million by 2045[1]. Diabetic retinopathy (DR) is a major complication of diabetes mellitus that can result in retinal vascular abnormalities and severe visual impairment. Diabetic retinopathy is defined as a vascular disease resulting from hyperglycaemia, and is characterized by altered structure of retinal endothelial vessels and disrupted blood–retinal barrier [2].Vitamin D deficiency is involved in impaired glucose tolerance or type-2 diabetes. Vitamin D deficiency seems to produce insulin resistance by causing an impaired insulin secretion via the vitamin D receptor in the beta cells of the pancreas and impaired insulin sensitivity [3]. Evidence shows that vitamin D may affect the pathogenesis of diabetic retinopathy via its effects on angiogenesis by changing the presence of hypoxia inducible products, such as vascular endothelial growth factor (VEGF). Ben-Shoshan et al [4], 2007 reported that 1, 25 (OH) 2D3 decreases the protein expression of both regulated hypoxia-inducible factor (HIF)-1α subunit and the VEGF in human cancer cells. Vitamin D deficiency influences the activity of tissue matrix metalloproteinase (MMPs) and C-reactive protein (CRP) that are involved in microangiopathies [5]. Since, the vitamin D deficiency is very common in India and the prevelance of diabetic retinopathy is also at increasing rate, keeping the significance of protective role vitamin D in mind the present study was undertaken to estimate the serum levels of vitamin D in patients of diabetic retinopathy.

OBJECTIVES

To estimate the serum levels of vitamin D in patients of diabetic retinopathy and to compare the difference between serum levels of vitamin D in different types of diabetic retinopathy, diabetics without retinopathy and healthy individuals.

METHOD AND MATERIALS

The present study was a cross sectional study undertaken on 182 patients, who presented to the Retina service and the Ophthalmology Outpatient Department of Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh. Approval was obtained from the institutional ethics committee. All the Tenets of the Declaration of Helsinki were

followed. A well informed written consent for ocular examination and blood sampling was taken from all the patients included in the study. Individuals diagnosed as case of diabetic retinopathy is in the study group. Patients receiving vitamin D and calcium supplements within 4 weeks and those taking any other medication that could change vitamin D metabolism, such as rifampin or phenytoin were exluded from the study. The patients were divided into four categories as non proliferative diabetic retinopathy, proliferative diabetic retinopathy, diabetics without retinopathy and healthy individuals. Statistical analysis was done using SPSS 26.0 for Windows software (SPSS Inc. Chicago, Illinois, USA). The difference in the mean serum levels of serum vitamin D levels between various groups were analysed using one way ANOVA test.

RESULTS

In the Non proliferative diabetic retinopathy patients mean serum vitamin D was 22.36 ± 4.90 ng/ml with minimum and maximum levels of 11.5 and 32.0 ng/ml respectively. In the Proliferative diabetic retinopathy patients mean serum vitamin D was 21.03 ± 6.21ng/ml with minimum and maximum levels of 11.20 ng/ml and 34.20 ng/ml respectively. In the Diabetics without retinopathy Patients mean serum vitamin D was 26.44 ± 4.98 ng/ml with minimum and maximum levels of 18.40 ng/ml, and 35 ng/ml, respectively.

Whereas, in the Healthy controls mean serum vitamin D was 35.80 ± 5.20 ng/mL with minimum and maximum levels of 28.50 ng/ml and 51.20 ng/ml respectively (Table 1, Figure 1).The mean serum vitamin D levels were lowest in Proliferative diabetic retinopathy (21.03 ± 6.21 ng/ml) followed by Non proliferative diabetic retinopathy (22.36 ± 4.90 ng/ml) (Group A) and Diabetics without retinopathy (26.44 ± 4.98 ng/ml). The difference in the levels of mean serum vitamin D between all diabetic patients and healthy controls using independent sample T test was statistically significant ($p<0.05$) (Table 2). The difference in the mean serum vitamin D levels between various groups was found to be statistically significant ($p<0.05$) using one way ANOVA test. After determining that the differences exist among the means, Post Hoc range test (Tukey) was used for group wise comparison. However, it was found that the difference in levels of mean serum vitamin D in PDR when compared with NPDR was not statistically significant ($p=1.00$) (Table 3).

The difference in levels of serum vitamin D between Proliferative diabetic retinopathy (21.03 ± 6.21ng/ml) and Diabetics without retinopathy (26.44 ± 4.98 ng/ml) was statistically significant ($p<0.05$). The difference in levels of serum vitamin D between Proliferative diabetic retinopathy (21.03 ± 6.21ng/ml) and Healthy controls (35.80 ± 5.20ng/ml) was statistically significant ($p<0.05$). The difference in levels of serum vitamin D between Non proliferative diabetic retinopathy (22.36 ± 4.90ng/ml) and Diabetics without retinopathy (26.44 ± 4.98 ng/ml) was statistically significant ($p<0.05$).The difference in levels of serum vitamin D between Non proliferative diabetic retinopathy (22.36 ± 4.90ng/ml) and healthy controls (35.80 ± 5.20ng/ml) was statistically significant ($p<0.05$).

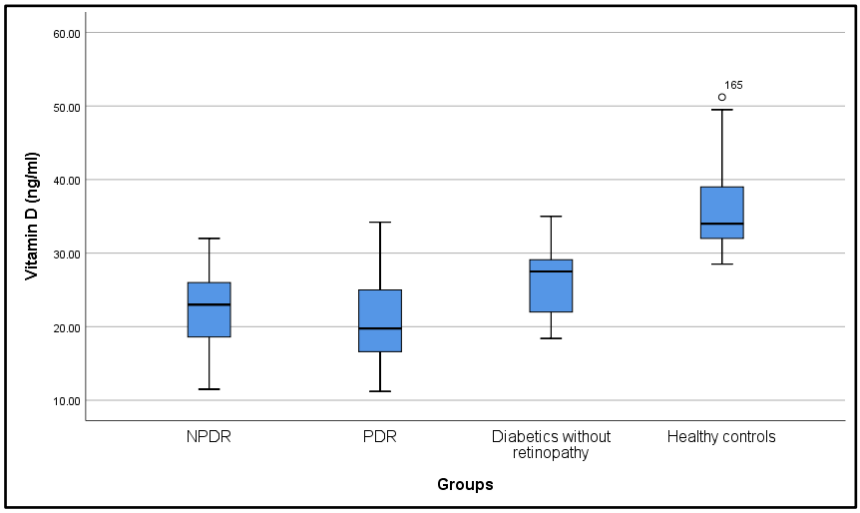

Figure 1: Mean Serum Vitamin D Levels In Various Groups

Table 1: Mean Serum Vitamin D Levels In Various Groups Using One Way Anova

Groups	Vitamin D levels (mg/dl)			P
	Maximum	Minimum	Mean ± SD	
Non proliferative diabetic retinopathy (Group A)	32.00	11.50	22.36±4.90	< 0.05
Proliferative diabetic retinopathy (Group B)	34.20	11.20	21.03±6.21	
Diabetics without retinopathy (Group C)	35	18.40	26.44±4.98	
Healthy controls (Group D)	51.20	28.50	35.80±5.20	

Table 2: Statistical Analysis of Mean Vitamin D Levels between All Diabetics Patients and Healthy Controls

Groups	T	P
Diabetics vs Healthy Controls	-12.16	<0.05

Table 3: Group Wise Comparison of Mean Vitamin D Levels Using Post Hoc Test (Tukey)

Groups	P	95% confidence interval	
		Lower bound	Upper bound
NPDR (Group A) Vs PDR (Group B)	1.000	-1.601	4.254
NPDR (Group A) Vs Diabetics Without Retinopathy (Group C)	0.002	-7.012	1.156
NPDR (Group A) Vs Healthy controls (Group D)	0.000	-16.301	-10.584
PDR (Group B) Vs Diabetics Without Retinopathy (Group C)	0.001	-8.996	-1.825
PDR (Group B) Vs Healthy controls (Group D)	0.000	-18.298	-11.240
Diabetics Without Retinopathy (Group C) Vs Healthy controls (Group D)	0.000	-12.887	-5.829

DISCUSSION

Diabetes is a group of serious metabolic diseases characterized by poor glycaemic control. In recent years, the prevalence of diabetes has increased rapidly globally, with an estimated 451 million people living with diabetes worldwide in 2017 and it is expected to increase to 693 million by 2045 [1]. Vitamin D affects the pathogenesis of diabetic retinopathy via its effects on angiogenesis by changing the presence of hypoxia inducible products, such as vascular endothelial growth factors [4]. Evidences suggest that, through its effects on the immune system, vitamin D may play a role in the pathogenesis of diabetic retinopathy (DR) [6]. Ashinne et al [7], in a study reported that that serum 25(OH) D levels were lower in patients with retinopathy compared to those without diabetic retinopathy. In another study conducted by Afarid et al [8], it was observed that the mean serum 25 (OH) D concentration in patients with diabetic retinopathy was lower than in those without diabetic retinopathy. Similarly in the present study it was observed that the mean serum vitamin D levels was lower in patients with diabetic retinopathy (NPDR 22.36 ± 4.90 ng/ml; PDR 21.03 ± 6.21ng/ml) as compared to diabetic patients without retinopathy (26.44 ± 4.98 ng/ml). Aksoy et al [9] in study reported that the serum 1, 25(OH)2D3 concentrations was the lowest in Proliferative diabetic retinopathy likewise in the present study it was observed that the mean serum vitamin D levels was lowest in patients with Proliferative diabetic retinopathy.

CONCLUSION

The observations made during the course of study led to the conclusion that the serum vitamin D levels were lower in Type 2 diabetic patients as compared to Healthy controls. The serum vitamin D levels were lower in diabetic patients with retinopathy as compared to diabetic patients without retinopathy. The serum vitamin D levels were slightly lower in Proliferative diabetic retinopathy patients as compared to Non proliferative diabetic retinopathy patients.

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