

A Study on Association between Vitamin D Deficiency and Diabetic Retinopathy in Type 2 Diabetes Mellitus

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Abstract: ***Aim:** To study the association between vitamin D level and diabetic retinopathy and to estimate the vitamin D level with severity of diabetic retinopathy in type 2 diabetes mellitus patients. **Method:** 100 patients with type 2 diabetes mellitus were considered for this study. Out of which only 96 patients were included after qualifying the inclusion and exclusion criteria. 41 patients without retinopathy and 55 patients with retinopathy were taken. Detailed history of the patients was taken followed by thorough general and ocular examination. Blood investigations including serum 25(OH)D were done. **Result:** The mean vitamin D level in the patients without retinopathy was 54 ± 6.84 ng/dl and those with retinopathy was 39 ± 9.97 ng/dl. The mean vitamin D level in patients without DR was 54 ± 6.84 ng/dl, 41.76 ± 8.85 ng/dl in NPDR, 28 ± 3.65 ng/dl in PDR and 29.2 ± 4.47 ng/dl in DME. **Conclusion:** We found that the patients with diabetic retinopathy had lower level of vitamin D than in patients without diabetic retinopathy and the level of vitamin D is inversely associated with the severity of diabetic retinopathy.*

Keywords: Vitamin D, diabetes mellitus, glycosylated haemoglobin, diabetic retinopathy, severity of diabetic retinopathy.

1. Introduction

Diabetes mellitus and its complications is one of the most common disorders in the present healthcare scenario and it affects almost all the system of the body. It is caused either due to inadequate production of insulin or due to inability of the body to respond to the insulin produced by the pancreas¹. In 2018, more than 500 million cases of type 2 diabetes mellitus have been reported worldwide². India is also estimated to have 109 million cases of type 2 diabetes mellitus by 2035³. Diabetic retinopathy is one of the most common microvascular complications of diabetes mellitus and is one of the leading causes of preventable blindness and visual impairment⁴.

Role of vitamin D in diabetic retinopathy in type 2 diabetes mellitus: Vitamin D is now known to have vast actions in various physiological processes other than bone remodelling and mineral homeostasis. Some of the important actions of vitamin D are its role as osteocalcin, immunomodulators, anti-inflammatory, anti-angiogenic, anti-oxidant and anti-proliferative⁵. In an animal study on mouse model, it was found that calcitriol is a potent inhibitor of neovascularisation in an oxygen induced ischaemic retinopathy and thereby vitamin D may play a protective role in the pathogenesis of diabetic retinopathy⁶. Some of the study shows that there is an association between vitamin D and diabetic retinopathy while some of the study showed no association between vitamin D and diabetic retinopathy. The association between the vitamin D and diabetic retinopathy in different studies is still conflicting but if this association is proven then the development and progression of diabetic retinopathy in patients with type 2 diabetes mellitus can be prevented or halted merely by improving the level of vitamin D.

2. Materials and Methods

This study was an institutional based observational study conducted in Regional Institute of Ophthalmology, Gauhati Medical College and Hospital. A total of 100 patients with type 2 diabetes mellitus were screened and 96 patients were included in the study after qualifying the inclusion and exclusion criteria. 55 patients were found to have diabetic retinopathy and 41 cases of diabetic patients without retinopathy. An informed and written consent was obtained and Institutional ethical committee clearance was taken prior to conducting the study.

Inclusion Criteria:

- Diagnosed cases of type 2 diabetes mellitus patients.
- Age group between 20-80 years were included.
- Both sexes were included.

Exclusion Criteria:

- Any media opacity obscuring fundus evaluation.
- Conditions mimicking diabetic retinopathy – hypertensive retinopathy, retinal vascular occlusion, traumatic macular edema, age related macular degeneration, choroidal neovascularization, other causes of macular edema.
- Patients with renal and hepatic diseases were excluded.
- Cardiovascular complications like coronary disease, cerebrovascular disease, peripheral artery disease, renal disease.
- Pregnant patients.
- Patients who are taking oral supplements containing vitamin D or calcium.

All subjects were subjected to detailed history and clinical examination and the findings were documented. In all cases,

general and systemic examination was done. A detailed Eye examination was done. Retinopathy was classified according to the International Clinical Disease Severity Scale.

Diabetic macular edema (DME), if present is again graded into mild, moderate and severe DME based on the distance of hard exudates from the centre of the fovea.

Fundus photograph and Optical coherence tomography imaging of all diabetic retinopathy cases were recorded. Due to limited resources and large number of patients, Fundus Fluorescein Angiography and OCT was done only wherever needed.

Lab Investigations

Test for estimation of Serum 25(OH)D was done using the product Total 25-OH Vitamin D EIA (Enzyme Immunoassay) Kit by Epitepe Diagnostics, Inc (EDI).

3. Result

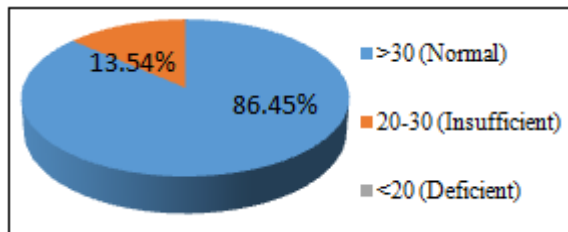


Figure 1: Shows the level of Vitamin D in diabetic patients:

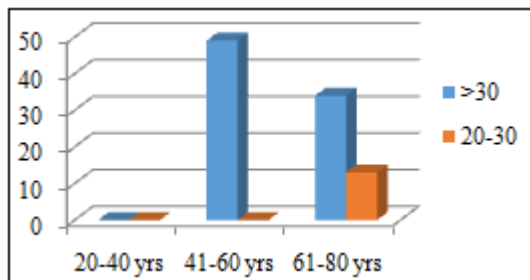


Figure 2: Shows age distribution and the Vitamin D level:

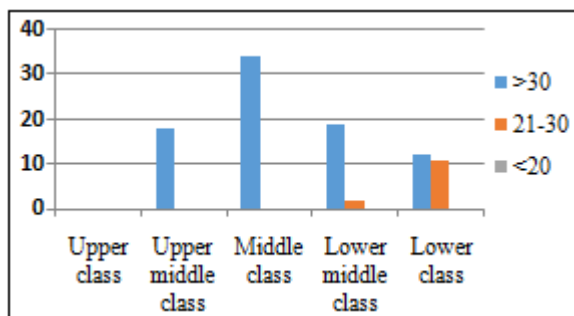


Figure 3: Shows Socio-economic status and Vitamin D level:

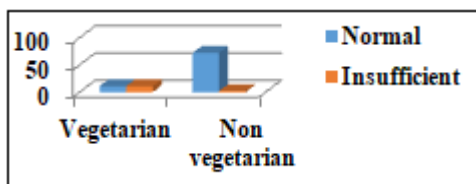


Figure 4: Shows vitamin D and Dietary habits

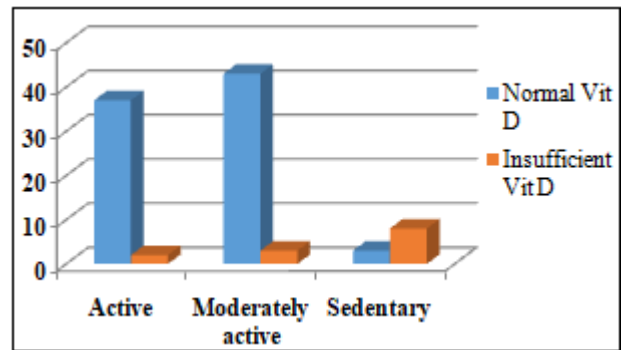


Figure 5: Shows the physical activity of patients with the level of vitamin D:

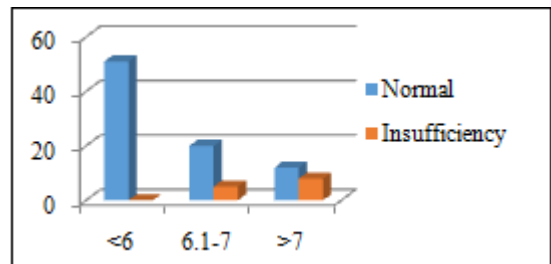


Figure 6: Shows HbA1c level with Vitamin D level in Type 2 DM patients:

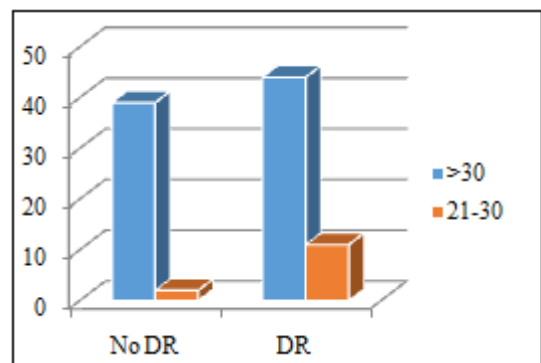


Figure 7: Shows the association between diabetic retinopathy and Vitamin D level

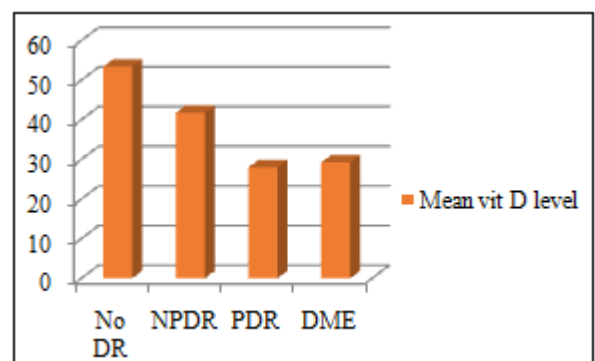


Figure 8: Shows association between vitamin D level and diabetic retinopathy

4. Discussions

In our study, only 13.54% of the diabetics had insufficient Vitamin D level and 86.45% patients had normal vitamin D level. None of the patient was found to have Vitamin D deficiency. The Mean ± SD for Vitamin D level was 45.25±11.34.

The percentage of patient having vitamin D insufficiency belongs to the age group of 61-80 years. It can be noted that advancing age of a diabetic patient is inversely associated to the level of vitamin D. This result is similar with that of the study by **F. Michael Gloth III et al.** where they found that 38% of elderly age group in the nursing home residents had Vitamin D deficiency⁷. They also mentioned that elderly people have a higher risk of having a vitamin D deficiency due to a combination of several risk factors, including: decreased sunlight exposure, decreased intake of vitamin D in the diet, and decreased skin thickness which leads to further decreased absorption of vitamin D from sunlight⁷.

In our study, we found that 84.61% of the patients having insufficient Vitamin D level belonged to the lower class category and 15.38% belonged to the lower middle class. It is noteworthy to mention that all patients belonging to middle, upper middle and upper class had normal Vitamin D level. In a similar study by **Seema Puri et al.** among the schoolgirls (6–18 years) from the lower (LSES, n 1477) and upper socioeconomic strata (USES, n 1650), clinical vitamin D deficiency was noted in 11.5 % girls (12.4 % LSES, 10.7 % USES)⁸.

In our study, it was found that 84.61% of the insufficient Vitamin D group are vegetarian by diet and only 15.38% are non vegetarian. Dietary habit seems to play a major role in the vitamin D level in this study. In a study by **P Millet et al.**, the percentage of subjects assessed as abnormal by blood vitamin concentrations was higher in vegetarians for vitamin B-12 (serum vitamin B-12) and vitamin D, which indicated a higher risk for a deficiency of vitamins B-12 and D in this group⁹.

In our study, 61.53% of the patients with insufficient Vitamin D status had sedentary lifestyle, 23.07% were moderately active and 15.38% group were active. Similar to our study, **Catherine M. Gordon et al** in their study found out that physical activity was significant independent predictors as potential risk factor for hypovitaminosis D¹⁰.

In our study, among the vitamin D insufficient group, 61.53% had HbA1c level of >7 and 38.46% had HbA1c level of 6.1-7. Among the patients with normal vitamin D level, 61.44% had HbA1c of <6. In a study by **Anuya Chauhan et al.**, 59% of the vitamin D deficient group showed poor control with HbA1c of more than 7¹¹.

84.61% of vitamin D insufficient patients had diabetic retinopathy and only 15.38% did not have diabetic retinopathy. The mean vitamin D level among the patients without diabetic retinopathy is 54±6.84 and among the patients with retinopathy, the mean vitamin D level is 39 ± 9.97. In our study, the Mean±SD of vitamin D level in patients with no DR is 54±6.84, NPDR is 41.76±8.85, PDR is 28±3.65 and DME is 29.2±4.47. Similar to our study by **Patric et al.**, an association was found between serum 25(OH)D concentration and diabetic retinopathy in type 2 diabetes mellitus patients¹².

However, in a study by **Uaazman Alam et Al.**, they found no difference in serum 25(OH)D between those with and without diabetic maculopathy¹³.

5. Conclusions

From our study, it can be concluded that vitamin D is lower in patients with diabetic retinopathy than in patients without diabetic retinopathy and is statistically significant. This was one of the aims and objectives of our study. The level of vitamin D is inversely associated to the development and severity of diabetic retinopathy in type 2 diabetes mellitus. The level of vitamin D is also determined by various other factors like socioeconomic status of the patient, dietary habits, physical activity, duration of sunlight exposure and HbA1c level and all of these factors are inversely associated to the level of vitamin D as found in our study. Improving the vitamin D status of the patients can prevent or delay the progression of diabetic retinopathy.

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