

**Vitamin D levels in Diabetic Nephropathy**Sujatha N Rao<sup>1\*</sup> Kuldeep GB<sup>2</sup>

<sup>1</sup>Professor, Department of Biochemistry AECS Maruthi College of Dental Sciences and Research Center, Bengaluru, India

<sup>2</sup>Chief Medical Administrator, Dept. of Medicine Sri, Krishna Sevashrama Hospital, Bengaluru, India

\*Correspondence: Dr Sujatha N Rao

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**Abstract**

**Objective:** This study aims to evaluate the levels of vitamin D in Newly Diagnosed Type 2 diabetics and in diabetics with nephropathy and to compare it with age matched healthy control.

**Method:** Cross sectional study involving a total of 316 individuals in Bengaluru, India from the period of December 2022 to November 2024 were considered for the study. Fasting venous blood and 24 hour urine sample was collected from 316 individuals comprising 124 N.D. type 2 Diabetics, 92 Diabetics with nephropathy and 100 healthy individuals and analysed for Glycosylated Hemoglobin(HbA1c), serum creatinine, vitamin D and urinary Albumin along with their demographic details.

**Results:** Age, gender had a statistical significance with diabetic nephropathy. There was significant decrease in the vitamin D levels only in Diabetics with nephropathy population compared to healthy and Newly Diagnosed type 2 Diabetics population although vitamin D levels in Newly Diagnosed Type 2 Diabetic population was lower than that of healthy population.

**Conclusion:** Variations in Vitamin D levels in these three population can be a signal of progression of Type 2 Diabetes into Diabetic Nephropathy. Hence monitoring of Vitamin D helps in early detection of diabetic complications thus preventing it from progressing further.

**Key words:** diabetic nephropathy, Vitamin D, creatinine, Albumin, HbA1c, Newly Diagnosed (N.D.) Type 2 Diabetics.

**Introduction**

Type II diabetes mellitus have been identified as the biggest silent lifestyle epidemics in the human history (1, 2). The increase in diabetes also amounts to incremental enhancement to the complications related to diabetes such as neuropathy, nephropathy, dyslipidemia, retinopathy, etc. The majority of the pa-

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tients die because of kidney diseases and cardiovascular complications -coronary artery disease, peripheral arterial disease and cerebrovascular complications, (3,4 ).India reported the second highest number of diabetes related deaths in the world (5). Among these, diabetic nephropathy, the most common microvascular complication, known to impact more than 1/3rd of the diabetics leading cause of ESRD world wide.(2, 4 ). Racial and Ethnic difference exist in the prevalence of Diabetic Nephropathy( 6 ) as noted by the researchers in the different parts of the world (7,8,9,10) Reason for Disparity may be due to the difference in their vitamin D levels (10,11)Vitamin D is not only obtained from the diet but also from the skin synthesis .Exposure to UV radiation in the range of 290-315nm converts 7 dehydrocholesterol to cholecalciferol also called pre vitamin D .Pre Vitamin D is converted to biologically active form through a 2 step sequential hydroxylation process ,first step occurs in the Liver where 25 hydroxy vitamin D (25OH D) is formed under the action of the enzyme 25 hydroxylase. It is the indicator of vitamin D level in the body .25OHD undergoes final activation step to become 1,25 dihydroxy vitamin D (1,25 (OH)2D). It is formed in the proximal convoluted tubules (PCT) of the kidney under the action of 1  $\alpha$  hydroxylase (12-14) Vitamin D is needed for the intestinal absorption of dietary calcium , its reabsorption at the PCT and preventing its resorption from the bone to the blood ,hence favouring osteoblastic activity and inhibiting osteoclastic activity ,maintaining the calcium level in the body . Optimum calcium level is needed for the secretion of insulin from the  $\beta$  cells of the pancreas (15-17). Several studies reported that vit D deficiency increases the risk of nephropathy ( 18-21 ).

Therefore our study aims to evaluate the Vitamin D

levels in Diabetics with nephropathy among south Indian population in Bengaluru ,South India as ethnic difference exists in the prevalence of Diabetic Nephropathy (6-11,12 ).Also association of ,vitamin D levels with Newly .Diagnosed .Type 2 Diabetics has not been studied till date.,Our study aims to evaluate Vitamin D levels in N.D.Type 2 Diabetics and in Diabetics with Nephropathy and to compare the results with that of healthy control population.

### **Study Design**

This is a cross sectional study conducted at the Shree Krishna Sevashrama Hospital, Bengaluru, Karnataka, South India from December 2022 to november 2024. A total of 316 Adult Individuals were included in this study, in the age group 34 to 72 years of both the gender. After obtaining the Institutional Ethical committee approval, informed consent was taken from all the individuals participated in the study. Individuals were categorized into 3 groups, based on their Hb A1c levels as per W.H.O. criteria. (22,23)

### **Inclusion criteria :**

Group I comprised of 100 healthy individuals with Hb A1c equal to or below 5.6 who had availed wellness plan offered by the institution , in the age ranging from 34 to 72 years of either gender .

Group II comprised of 124 Newly. Diagnosed. type 2 Diabetics with Hb A1c level 6.5 or above.

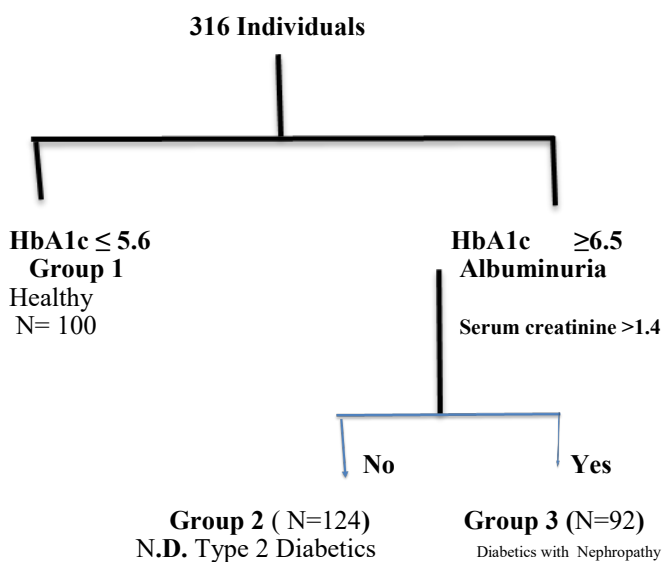
Group III comprised of 92 confirmed patients of Type 2 DM with nephropathy, exhibiting symptoms such as oedema, albuminuria with low albumin levels in the blood and serum creatinine higher than 1.4 mg/dl.

**Exclusion criteria** for all the above 3 groups, pregnant and lactating women, individuals taking medications are excluded.

**Sample collection and Biochemical Analysis**

After an overnight fast, blood samples were obtained for biochemical analysis. Sample collection involved venous whole blood sample. Portion of it was transferred to EDTA tubes and centrifuged to obtain plasma, for the analysis of Hb A1c and the other portion was allowed to clot. Serum was separated and used for the analysis of creatinine and vitamin D.

**Figure 1** – Flow Chart for the selection of study Population



Analysis was performed using Olympus AV Auto analyser, using Diasys reagents manufactured by Diasys Diagnostic system, GmbH, Holzheim, Germany, Serum Creatinine was analyzed by jaffe’s kinetic method.. 24 h urine samples were collected for the qualitative detection and quantitative estimation of urinary Albumin for confirmation / to rule out albuminuria by immunoturbidimetric method, Serum Vitamin D 25OHD levels were estimated using a chemiluminescent immunoassay by Roche Diagnostics, Mannheim, Germany. As per WHO, vitamin D levels <10 ng/mL is con-

sidered as severe deficiency, < 20 ng/mL as deficient, 20 ng/m -- 29 ng/mL as Insufficient, and ≥30 ng/mL as sufficient. Plasma Hb A1c was measured using particle enhanced Immuno turbidimetric method(24) and the desirable range for healthy population was ≤ 5.6, for prediabetes 5.7 – 6.4, for diabetes ≥ 6.5. Result of all the above parameters were expressed as mean with standard deviation,

**Statistical Analysis:** Data were analysed using SPSS statistical version 24. One way Analysis of Variance (ANOVA) was performed to compare the means of the three groups. Statistical difference between any 2 groups among the total 3 groups was measured by ‘t’ test. Results of all the tests with p < 0.05 were considered statistically significant and at P < 0.01 were highly significant.

**Result**

**Table 1:** Levels of HbA1c, Serum Creatinine, urinary Albumin in the study groups as per inclusion Criteria.

Parameter	Normal Range	Group 1 Healthy Control N=100	Group 2 N.D. Type 2 Diabetics N=124	Group 3 Diabetics with Nephropathy N=92
HbA1c	≤ 5.6 Normal 5.7-6.4 Prediabetes ≥6.5 Diabetes.	5.11 ± 0.30	7.83±1.16	8.82±1.34
Serum Creatinine mg/dl	0.6-1.4	1.09 ± 0.14	1.2±0.10	2.0 ±0.11
Albuminuria		---- ve	---- ve	+ ve

Table 1 shows HbA1c levels of Group 1 Healthy Controls (5.11±0.30 ),Group 2 N.D.T2DM (7.83±1.16 ) and Group 3 DN (8.82± 1.34). Serum Creatinine levels in Group 1 ( 1.09± 0.14) in Group 2( 1.2± 0.10)and in Group 3 (2.0±0.11). Urinary Albumin was present only in Group 3 and was absent in Group 1 and 2.

**Table 2:** Comparison of Demographic data of study groups. Significant at P < 0.05, Highly significant at P< 0.01

Parameter	Group 1 Healthy Control N=100	Group 2 N.D.Type2 dia- betics N= 124	Group 3 Diabetics with Nephropathy N=92	X2 ( chi square )	P value
Age in years	42.52± 8.26	50.43±12.65	61.49 ± 10.40	50.89	0.000
Gender					
Males	39 (39%)	72 (58%)	81(88%)	26.43	0.000
Females	61(61%)	52(42%)	11 (12%)		

As shown in Table 2, mean age of diabetics with nephropathy was significantly higher (61.49±10.40 , ,x 2 =50.89 ,p=0.000) than the mean age of the N.D.type 2 Diabetics (50.43 ± 12.65) and that of the control group (42.52± 8..26 ). Association of gender with diabetic nephropathy was also observed to be statistically highly significant ( x2=26.43 p=0.000). Males comprised of 39 % of the control group , 58% of N.D.Diabetics and 88% of diabetics with nephropathy group. Females comprised of 61% of control group, 42% of N.D.type2 diabetics and 12%of diabetics with nephropathy group indicating that the Males were more prone to diabetic nephropathy compared to Females.

**Table 3 :** Serum Vitamin D Levels in the study groups. Significant at P< 0.05. Highly significant at P < 0.01

Parameter	Normal Range Serum Vitamin D ng/ml	Group 1 Healthy Control N= 100	Group 2 N.D.Type2 Diabetics N= 124	Group 3 Diabetics with Nephropathy N= 92	F Value	Significance
SerumVitaminD ng / ml	<10=severely Defecient <20= Defecient 21-29 = Insufficient ≥ 30= Suffecient >100= Toxicity					
Mean		44	32	12	78.351	0.033
Std.Deviation		9.5	8.3	7.9		

Table 3 shows the vitamin D levels in these three study groups . 44 ng/ml ± 9.5 in control healthy group, 32 ng/ml ± 8.3 in N.D. type 2 Diabetics and 12ng/ml ± 7.9 in diabetics with nephropathy group.. Both the group 1 and group2 had normal sufficient level of Vitamin D . Only group 3 had deficient amount of Vitamin D. There was significant difference in the levels of vit D between the three popula-tion (F=78.351 ,p=0.033).

**Table 4** comparison of Vitamin D levels between Group 2 and Group3. Significant at P < 0.05. Highly significant at P < 0.01.

Group		N	Mean	Std Deviation	t	Sig.
Serum vit D ng/ml	Group 2 N.D. type 2 Diabetics	124	32	8.3	47.656	0.000
	Group 3 Diabetics with Nephropathy	92	12	7.9		

Table 4 shows the comparison of vit D levels between group 2 and group 3. There was highly significant difference between these two groups in the level of vitamin D ( t = 47.656 ,p=0.000 ).

**Table 5** comparison of Vitamin D levels between Group 3 and Group1. Significant at P < 0.05. Highly significant at P < 0.01.

Group		N	Mean	Std Deviation	t	Sig.
SerumVit.D ng/ml	Group3 Diabetics with Nephropathy	92	12	7.9	60.174	0.000
	Group 1 Normal healthy	100	44	9.5		

Table 5 shows the difference in vit D levels between group 3 and the group 1 which is also highly significant ( t= 60.174,p= 0.000 ).

**Table 6** comparison of Vitamin D levels between Group 1 and Group 2groups .Significant at P < 0.05.Highly significant at P < 0.01

Group		N	Mean	Std Deviation	t	Sig.
Serum Vit D ng/ml	Group 1 Normal Healthy	100	44	9.5	19.913	0.027
	Group 2 N.D. Type 2 Diabetics	124	32	8.3		

Table 6 shows the difference in Vit D levels between Group 1 and Group 2 which is significant (29.913, p=0.027).

## Discussion

creased steadily and significantly from Group 1 to Group 2 and then to the lowest level in Group 3, it imparts the clarity regarding the changing pattern of vitamin D level in different clinical conditions. Regarding demographic variables, age had a statistically significant association with Diabetic Nephropathy. Chances of progression of Diabetes Newly Diagnosed one into Diabetic Nephropathy increased with age as per our study.. Regarding the gender, male diabetic patients were more prone to Nephropathy than females in our study.Both age and gender had an impact on diabetic nephropathy as per our study.

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Similar observations were reported by other researchers.(33-35).

### Conclusion

Our study showed deficient amount of vit .D in Diabetic Nephropathy. These variations in vitamin D levels can be a signal of progression of Type 2 Diabetes into Diabetic Nephropathy. Hence frequent monitoring of vitamin D and supplementation of vit D may help in early detection of diabetic complication thus preventing it from progressing further.

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### Disclosure statement

The authors have no conflicts of interest to declare.

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