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The Relationship between Levels of Serum Vit. D and Kidney Function in Diabetic Nephropathy Iraqi Patient

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Abstract:

Background: According to several animal and human studies, Vitamin D appears to play a substantial role in the development of diabetic nephropathy, However, the possibility of vitamin D's Reno protective impact and influence on the reversal of already-existing renal damage remains speculative. Vitamin D deficiency and insufficiency are ubiquitous worldwide and have been linked to a variety of pathophysiological conditions, including diabetes, allergies, autoimmune illnesses, pregnancy difficulties, and, more recently, worse COVID-19 clinical outcomes. From a translational perspective, the goal of this review is to look into the potential function of vitamin D in the development of diabetic kidney diseases

Aim of the study: to evaluate the role of vit. D on renal function in patient with DMT1.

Patient and Method: The total number of study participants was 120, divided into three groups: Group A: Included 40 patients has DM with NP (stage1, stage 2, stage 3a), Group B included 40 patients had DM without NP, and group C included 40 healthy participants (control). Samples were taken from the Diabetic control clinic of Endocrinology and Diabetes center/Al-Kindy Hospital, Baghdad Teaching Hospital/ Medical City and Al-Shaheed Al- Sadder General Hospital during the period from October 2021 to March 2022.

Result: Statistically significant weak positive correlations were detected between vitamin D and GFR (r= 0.321, P= 0.001); while significant moderate negative correlation was seen between vitamin D and HbA1c (r= -0.494, P= 0.001) and weak negative correlation was seen with B. Urea (r= -0.2, P= 0.028). No statistically significant correlations detected between vitamin D and all of age, DM duration, and s. creatinine.

Conclusion: Our data suggest a correlation between reduced levels of vitamin D3 and diabetes nephropathy and it may be a potential predictor for both the occurrence and severity of diabetic nephropathy.

Keywords: vitamin D3, diabetes mellitus, DMT1, diabetic nephropathy (DNP).

Introduction:

End-stage renal disease (ESRD) is most commonly caused by diabetes mellitus (DM), one of the most prevalent chronic diseases [1]. Recent research has placed a lot of emphasis on vitamin D insufficiency and diabetes because the latter has a significant impact on immunity and the management of diabetes [2]. Vitamin D is a steroid hormone that circulates in the bloodstream and mediates its biological effects through binding to vitamin D receptors (VDRs), which are found in the intestine, kidney, bone, testis, ovary, endometrium, placenta, pancreas, and immune system, among other organs [3].

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Vitamin D's effects are mediated by binding to its receptor (VDR), which is found in a variety of tissues throughout the human body, including the kidneys and more specifically in the proximal and distal tubular epithelial cells, [4]. Vitamin D must be metabolically activated in the kidney, and people with chronic kidney disease (CKD), especially diabetic kidney disease (DKD), are unable to produce enough of the active form (1,25(OH)2D) [5].

Analytical statistics Statistical Package for Social Sciences (SPSS) version 26 was used to analyze the data. The information is displayed in the form of a mean, standard deviation, and ranges. Frequencies and percentages are used to present categorical data. To examine continuous variables between study groups, the independent t-test and Analysis of Variance (ANOVA) (two-tailed) were utilized. The association between vitamin D and several biological markers was assessed using Pearson's correlation test (r). Significant was defined as a P- value of less than 0.05.

Methods and criteria

This cross-sectional study evaluated 120 patients with T1DM who attended the Diabetic Control Clinic of Endocrinology and Diabetes Center/Al-Kindy Hospital, Baghdad Teaching Hospital / Medical City, and Al Shaheed Al-Sadder General Hospital during the period from October 2021 to March 2022. DM was diagnosed according to the 2012 American Diabetes Association criteria.[6] The exclusion criteria were as follows: (1) type 2 diabetes or other types of diabetes, (2) acute diabetes complications, except nephropathy, (3) liver dysfunction, (4) parathyroid diseases, (5) severe cardiovascular and cerebrovascular diseases, (6) malignant tumors (7) lactating women or pregnant (8) cataract, glaucoma, and other eye diseases that interfered with fundus photography, and (9) treatment with drugs or nutrition supplements about 6 months ago that affected vitamin D metabolism.

Result

General characteristics

The distribution of study groups by general characteristics is shown in figure and table [1]. Study participants' age was ranging from 18 to 40 years with a mean of 27.02 years and a standard deviation (SD) of ±6.33 years. The highest proportion of study participants in groups A, B, and C was aged < 30 years (62.5%, 57.5%, and 75% respectively).

In our study, proportion of males and females was approximately the same in all groups; the highest proportion of participants in groups A, B, and C had normal BMI level (65.0%, 60.0%, and 55% respectively). Regarding DM duration, it was >10 years in 52.5% of group A and between 5-10 years in 55% of group B

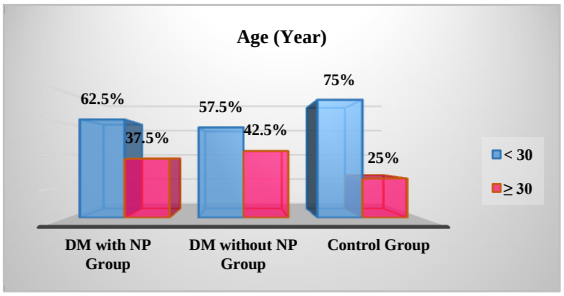

Figure 1: Distribution of study groups by age

In this study shows a comparison of groups based on key criteria in table (1). In group A, the mean BMI was substantially lower (23.03 kg/m2, P= 0.031), whereas the mean DM duration was much longer (13.82 years, P= 0.001).

There was no statistically significant age difference between the study groups (P=0.399).

Table 1: Comparison between study groups by certain characteristics

Variable	Study group			P - Value
	A Mean ± SD	B Mean ± SD	C Mean ± SD	
Age (Year)	27.42±6.8	27.72±7.0	25.92±5.1	0.399
BMI (Kg/m^2)	23.03±2.9	24.1±3.9	25.04±3.3	0.031
DM Duration (Year)	13.82±8.0	7.42±4.6	-	0.001

Investigation: Table 2 shows the comparison of investigation results between study groups. Means of FBS, HbA1c, B. urea, and albuminuria were significantly higher (P < 0.05) in group A than that in groups B and C.

Means of S. Ca, S. albumin, and GFR were significantly lower (P<0.05) in group A than that in groups B and C.

No statistically significant difference in the mean of s. creatinine between study groups (P= 0.083).

Table 2: Comparison of investigation results between study groups

Investigation	Study group			*P* - Value
	A Mean ± SD	B Mean ± SD	C Mean ± SD	
FBS (mg/dl)	278.56±122.4	262.07±98.8	87.43±6.3	0.001
HbA1c (%)	9.89±1.9	9.49±2.1	4.74±0.31	0.001
S. Albumin (gm/dl)	40.38±4.0	43.93±3.7	47.6±2.8	0.001
S. Ca (mg/dl)	9.89±1.9	9.31±0.5	9.57±0.36	0.001
B. Urea (mg/dl)	30.38±17.1	21.77±6.2	23.12±5.6	0.001
S. Creatinine (mg/dl)	1.01±1.2	0.71±0.08	0.72±0.1	0.083
Albuminuria (mg/g)	5.73±1.2	2.52±0.56	2.61±0.7	0.001
GFR	99.43±21.4	114.97±9.0	114.97±8.5	0.001

Vitamin D

In this study, we noticed that 57.5% of diabetic patients with NP (Group A) had deficiency in vitamin D level; 15% in diabetic patients without NP (Group B); while most of healthy subjects (Group C) had normal vitamin D level (80%) and nobody of them had vitamin D deficiency as shown in figure (2).

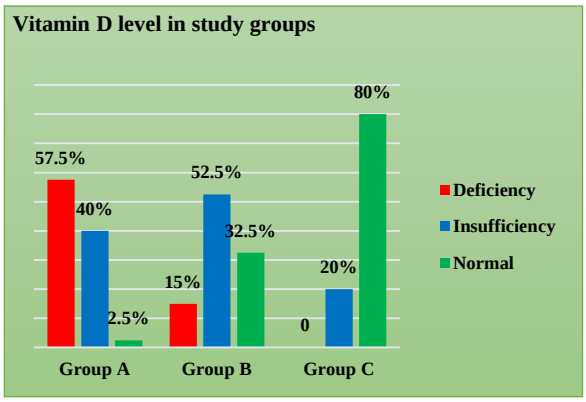

Figure 2: Vitamin D level in study groups.

As demonstrated in table (3), the mean vitamin D level in diabetes patients with NP (Group A) was considerably lower (19.13, P =0.001) than in diabetic patients without NP (Group B) and healthy persons (Group C). Post hoc tests (LSD) were used to confirm the differences in vitamin D mean between study groups, and they revealed that group A's mean vitamin D was substantially lower (P< 0.05) than groups B and C's. As demonstrated in table, it was also considerably lower (P< 0.05) in group B than in group C. table (3).

Table 3: Post hoc tests (LSD) to confirm the differences in mean of vitamin D between study groups

	Study group			P - Value
	A Mean±SD	B Mean±SD	C Mean±SD	
Vitamin D (ng/ml)	19.13±6.2	33.0±16.1	-	0.001
	19.13±6.2		51.88±17.0	0.001
	-	33.0±16.1	51.88±17.0	0.001

Vitamin D and some biological parameters are linked

Vitamin D was found to have statistically significant mild positive relationships with both BMI (r= 0.197, P= 0.031) and GFR (r= 0.321, P= 0.001), as well as a moderate negative connection with HbA1c (r=-0.494, P= 0.001) and a weak negative correlation with B. Urea (r= -0.2, P= 0.028). There were no statistically significant relationships between vitamin D and all of age, DM duration, and s. creatinine.

Table 4: Correlation between vitamin D and certain biological parameters

Variable	Vitamin D (ng/ml)	
	r	P - Value
Age (Year)	- 0.102	0.269
BMI (kg/m^2)	0.197	0.031
DM Duration (Year)	- 0.102	0.368
HbA1c (%)	- 0.494	0.001
B. Urea (mg/dl)	- 0.2	0.028
S. Creatinine (mg/dl)	- 0.11	0.232
GFR	0.321	0.001

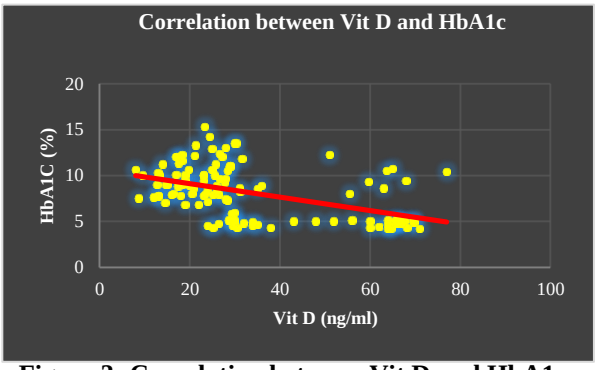

Figure 3: Correlation between Vit D and HbA1c.

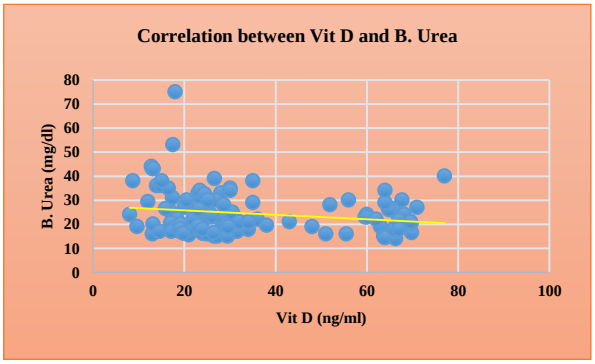

Figure 4: Correlation between Vit D and B. Urea.

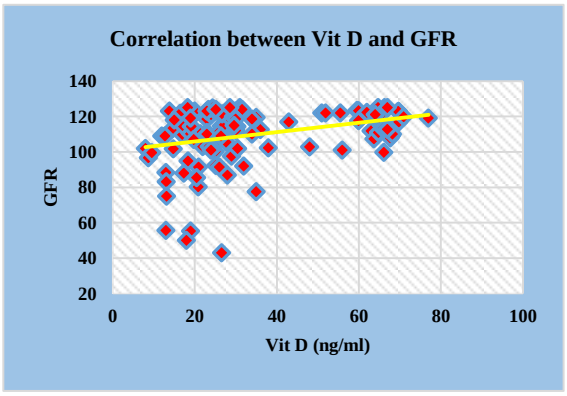

Figure 5: Correlation between Vit. D and GFR.

Discussion

Type 1 diabetes is an autoimmune endocrine disorder that causes insulin insufficiency and chronic hyperglycemia due to -cell death [6] Recent studies have shown that vitamin D biology has a significant role in the occurrence and development of type 1 diabetes (DM1) [7]. In our research, we focused on patients with type 1 diabetes in Iraqi/ Baghdad for the age group from 18 to 40 and focused on vitamin D3 because of its impact on the bones, kidneys, and immune system and on control of type 1 diabetes, especially after the corona pandemic and the need to maintain the level of D3 within the normal level, this is consistent with the recent study Franca Gois PH et al [8]. In this study, we investigated the relationship between vitamin D and renal function test outcomes in 80 patients with T1DM, and 40 healthy controls. The patients with diabetes are divided into two groups depending on the amount of albumin excreted in the urine. In group A (with nephropathy), we found albumin in the urine (microalbuminuria) and in the patients who were selected within stage 1, stage 2, and stage 3a, the urea and creatinine are normal, this matches the search Haukka JK [9] microalbuminuria has not been linked to any specific symptom [10]. Also revealed in this group that the lower serum levels of Albumin, Ca, GFR, VD, and higher serum level of HbA1c are similar to the other studies [11, 12]. While group B (diabetic without nephropathy), we found no albumin in urine normoalbuminuria, renal function test also is normal these results is consistent with other studies [13, 14, 15]. When comparing group A and group B, we notice that there are clear differences in the heights of FBS, HbA1c, and albuminuria and also arise in urea and S. Creatinine, although they are within the normal level, at its highest level compared to group B, also the patient with diabetic nephropathy group A showed a lower VD level, serum calcium, serum albumin, GFR respectively more than group B. Group A (microalbuminuria) and group B (normoalbuminuria), showed a decrease in the level of Vitamin D3 more than group C (healthy). Our data suggest an association between reduced levels of VD and diabetes in general and with the presence of microalbuminuria in diabetic patients with nephropathy especially. Vit. D plays several roles in the normal function of the kidney and metabolism. It has been revealed that Vit. D has a crucial impact on kidney disease and its deficiency leads to kidney dysfunction and further renal disorder. Apart from the direct relationship of Vit. D with kidney disease, the association of adipocytes and adipokines with Vit. D and kidney function have also been studied. The noticeable role of Vit. D in kidney disease is investigated in various studies. It has been found that Vit. D has a pivotal role in kidney function and metabolism (16). Also, we can consider microalbuminuria, an early indicator of diabetic nephropathy, is an increase in urine albumin excretion this is consistent with the study [17]. Patients with a vitamin D deficiency have a higher chance of developing DN [18, 19]. According to the Third National Health and Nutrition Examination Survey (NHANES III), decreased 25(OH) D 2 BioMed Research International concentration is linked to a higher prevalence of albumin urination in the general population, an independent link between VD deficit and DN was discovered in studies of persons with diabetes. The inadequacy of VD becomes more severe as the DN progresses [20]. Higher glycosylated hemoglobin A1C and the development of proteinuria were strongly associated with the risk of advanced-stage kidney disease [21, 22]. In conclusion, decreased vitamin D catabolism as determined by circulating 24, 25(OH) 2D concentration is substantially correlated with lower GFR this result corresponds with De Boer IH, et al [23]. Additional research is required to better understand vitamin D catabolism and how it alters CKD, as well as to evaluate whether monitoring vitamin D catabolism enhances clinical care and provides novel treatment strategies to treat CKD patients with impaired vitamin D metabolism.

Conclusion:

Our data suggest an association between reduced levels of vitamin D3 and diabetes nephropathy and it may be a potential predictor for both the occurrence and severity of DNP.

Authors' declaration

Conflicts of Interest: None.-We hereby confirm that all the Figures and Tables in the manuscript are mine/ ours. Besides, the Figures and images, which are not mine /ours, have been given permission for re-publication attached with the manuscript.-Authors sign on ethical consideration's approval-Ethical Clearance: The project was approved by the local ethical committee in College of Medicine / University of Baghdad according to **the code number (1562 .23.11.2021).**

Authors' Contributions:

Study conception, Study design and Critical revision: Nadia aliwi Mijbel,

Ass prof. Shifaa Jameel Ibrahim -

Acquisition of data analysis, Drafting of manuscript and Interpretation of data: Nadia Aleiwi Mejbel and **Shifaa Jameel Ibrahim**

Reference

1-Saleh MM, Dhamad GD, Kamel LA. Inflammatory markers mediated diabetic nephropathy in patients with type 1 and type 2 diabetes mellitus. Journal of the Faculty of Medicine Baghdad. 2014; 56(4):401-4.

2-Samsu N. Diabetic nephropathy: challenges in pathogenesis, diagnosis, and treatment. BioMed Research International. 2021 Jul 9; 2021.
3-Hamdi RA, Abdul-Qahar ZH, Kadhum EJ, Alsaeed FA. Assessment of Serum Vitamin D Levels in Women with Polycystic Ovary Syndrome. Journal of the Faculty of Medicine Baghdad. 2018 Sep 2; 60(2):93-7
4-Mazanova A, Shymanskyi I, Lisakovska O, Hajiyeva L, Komisarenko Y, Veliky M. Effects of cholecalciferol on key components of vitamin D-endo/para/autocrine system in experimental type 1 diabetes. International Journal of Endocrinology. 2018 Feb 6; 2018.
5-Galuška D, Pácal L, Kaňková K. Pathophysiological Implication of Vitamin D in Diabetic Kidney Disease. Kidney and Blood Pressure Research. 2021; 46(2):152-61.
6-Paschou SA, Papadopoulou-Marketou N, Chrousos GP, Kanaka-Gantenbein C. On type 1 diabetes mellitus pathogenesis. Endocrine connections. 2018 Jan 1; 7(1):R38-46.
7-Kulie T, Groff A, Redmer J, Hounshell J, Schrager S. Vitamin D: an evidence-based review. The Journal of the American Board of Family Medicine. 2009 Nov 1; 22(6):698-706.
8-Franca Gois PH, Wolley M, Ranganathan D, Seguro AC. Vitamin D deficiency in chronic kidney disease: Recent evidence and controversies. International journal of environmental research and public health. 2018Aug; 15(8):1773.
9-Haukka JK, Sandholm N, Forsblom C, Cobb JE, Groop PH, Ferrannini E. Metabolomic profile predicts development of microalbuminuria in individuals with type 1 diabetes. Scientific Reports. 2018 Sep 14; 8(1):1-0.
10- Prasad RM, Tikaria R. Microalbuminuria. [Updated 2022 Apr 30]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan- 11-MacIsaac RJ, Jerums G, Ekinci EI. Effects of glycaemic management on diabetic kidney disease. World journal of diabetes. 2017 May 15; 8(5):172. 12-- Razip, N.N.M., Gopalsamy, B., Abdul Mutalib, M.S., Chang, S.K., Abdullah, M.M.J.A., Azlan, A., Rejali, Z. and Khaza'ai, H.,. Correlation between levels of vitamins D3 and E in type 2 diabetes mellitus: A case-control study in Serdang, Selangor, Malaysia. Nutrients, 13(7), p.2288.2021 jul

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العلاقة بين مستوى فيتامين د في المصل ووظيفة الكلى في مرضى اعتلال الكلية السكري العراقي

الكيمياوي الاختصاص : ناديا عليوي مجبل م. الصدر
استاذ مساعد: شفاء جميل ابراهيم كلية الطب/ فرع الكيمياء/ جامعة بغداد

الخلاصة
الخلفية: وفقًا للعديد من الدراسات التي أجريت على الحيوانات والبشر ، يبدو أن فيتامين (د) يلعب دورًا جوهريًا في تطوير اعتلال الكلية السكري ، ومع ذلك ، فإن إمكانية تأثير فيتامين (د) الوقائي وتأثيره على عكس الضرر الكلوي الموجود بالفعل لا تزال تخمينية. ينتشر نقص فيتامين (د) ونقصه في كل مكان في جميع أنحاء العالم وقد تم ربطهما بمجموعة متنوعة من الحالات الفيزيولوجية المرضية ، بما في ذلك مرض السكري ، والحساسية ، وأمراض المناعة الذاتية ، وصعوبات الحمل ، ومؤخراً ، أسوأ النتائج السريرية لـ COVID-19. من منظور متعدية ، الهدف من هذه المراجعة هو النظر في الوظيفة المحتملة لفيتامين د في تطور مرض الكلى السكري.
الهدف: تقييم دور فيتامين د في وظائف الكلى لدى المريض المصاب بالسكري النوع الاول 1
المريض والطريقة: ا. العدد الإجمالي للمشاركين في الدراسة 120 تم تقسيمهم إلى ثلاثة مجموعات: المجموعة أ: تضمنت 40 مريضًا مصابًا بداء السكري النوع الاول مع الاعتلال الكلوي (المرحلة 1، المرحلة 2، المرحلة 3 أ)، المجموعة ب شملت 40 مريضًا مصابًا بمرض السكري فقط بدون اعتلال كلوي، والمجموعة ج تضم 40 شخص كانوا مشاركين أصحاء الذين حضروا عيادة السيطرة على مرض السكر في مركز الغدد الصماء والسكري / مستشفى الكندي، مستشفى بغداد التعليمي / المدينة الطبية ومستشفى الشهيد الصدر العام خلال الفترة من أكتوبر 2021 إلى مارس 2022.
النتيجة: تم الكشف عن ارتباطات إيجابية ضعيفة ذات دلالة إحصائية بين فيتامين (د) و GFR (ص = 0.321 ، P = 0.001) ؛ بينما لوحظ ارتباط سلبي معتدل بين فيتامين د و HbA1c (r = -0.494، P = 0.001) ووجد ارتباط سلبي ضعيف مع (B. Urea r = -0.2 ، P=0.028) وايضا وجد في هذه الدراسه عدم وجود علاقه بين فيتامين د مع كل من (العمر , مدة المرض , الكرياتينين)
الخلاصة: تشير بياناتنا إلى وجود ارتباط بين انخفاض مستوى فيتامين D3 واعتلال الكلية السكري وقد يكون مؤشرا محتملا حدوث الاعتلال الكلوي وشدته.

الكلمة الرئيسية: فيتامين د ، داء السكري ، داء السكري النوع الاول، اعتلال الكلية السكري.