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ORIGINAL ARTICLE

Role of Vitamin D at Urinary Level as a Potential Biomarker in Diabetic Nephropathy among Pakistani Population

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ABSTRACT

Introduction: Diabetic nephropathy (DN) is a microvascular complication of diabetes mellitus and it's a leading cause of end-stage renal disease (ESRD) worldwide.

Objectives: The main objective of the study is to find the role of Vitamin D at urinary level as a new biomarker in analysis of diabetic nephropathy in Pakistani population.

Methodology: This cross-sectional study was conducted at Sahara Medical College Narowal from February 2022 to March 2023. Data were collected according to inclusion and exclusion criteria from 550 patients suffering from DN. Demographic and clinical data were collected from each patient through systematically designed performa which contain questions related to duration of disease, history, medication, glycemic control and all other related data. Urinary sample were drawn from every patient to measure the levels of Vit-D in urine.

Results: Data were collected from 550 confirmed patients of DM. Mean age of the participants was 55.3 ± 9.7 years. There were 302 (55%) male population and 248 (45%) female population in the study. Mean duration of DM were 9.89±2.34 years and mean levels of HbA1c was 8.5 ± 1.2 (%). There were 50 patients who had urinary Vit-D levels were <10ng/mL, 200 with 10-20ng/mL, 250 with 20-30ng/ml and 50 patients had >30ng/mL. In type I DM patients mean levels of urinary Vit-D was 18.5 ± 4.0 ng/mL and in type II 21.0 ± 5.0 ng/ml. Patients with eGFR <60 have 19.0 ± 4.0ng/mL, 60-90 with 23.0 ± 5.0ng/mL and >90 with 25.0 ± 5.0ng/mL urinary vit-D levels.

Conclusion: It is concluded that Vit-D levels shows an inverse relationship with albumin to creatinine ratio in diabetic nephropathy patients which suggest strong reno-protective effect against DN. Urinary Vit-D levels is considered to be a potential biomarker in the assessment of DN and renal functions in Pakistani population suffering from DM.

Keywords: Patients, Vit-D, DM, Population, Urinary, Creatinin.

INTRODUCTION

Diabetic nephropathy (DN) is a serious microvascular complication of diabetes mellitus and a leading cause of end-stage renal disease worldwide. Early detection and management of DN are crucial for forestalling its progression to renal failure.As of late, there has been developing interest in distinguishing novel biomarkers for the early detection and monitoring of DN[1]. Vitamin is an organic supplement which is essential and is expected in little amounts. A vitamin cannot be synthesized by the human body[2]. Vitamin D, traditionally known for its part in bone health and calcium homeostasis, has emerged as a potential biomarker for DN because of its pleiotropic impacts, including regulation of inflammation, safe function, and vascular health. Vitamin D-binding protein is also called Gc globulin, with a molecular load of 51,000-58,000[3,4]. It was first isolated from plasma α2-globulin by Hirschfeld in 1959. VDBP is mainly synthesized by the liver, and the kidneys can also emit a small amount of VDBP, which is sifted in the glomerulus and reabsorbed in the proximal tubules[5]. Lately, urinary VDBP, as an important renal tubular early damage marker in DKD, has gotten widespread attention, and various examinations have found that urinary VDBP is abnormally elevated in early DKD and can subsequently be utilized as a biomarker for the early diagnosis of DKD[6]. Be that as it may, one review tracked down no association among VDBP and DKD. Diabetes mellitus is categorized into Type-1 diabetes mellitus (T1DM) and T2DM. In ongoing decades, the increasing health weight of T2DM has turned into a major international concern[7]. T2DM has been accounted for in >95% of individuals with diabetes. Globally, approximately 462 million individuals are affected by T2DM, which addresses 6.28% of the world's population[8]. Risk factors for the improvement of T2DM incorporate stoutness, sedentary way of life, alcohol utilization, smoking, and fatty diet. The primary organs affected with T2DM are skeletal muscles, brain, and kidneys[9]. Approximately 40% of patients with diabetes are diagnosed with DN, which is characterized by kidney dysfunction and proteinuria. The recurrence of DN increases with an increase in T2DM rises. Kidneys play a crucial role in vitamin D metabolism by controlling the reabsorption of calcium and phosphate and by regulating the synthesis of the active form of vitamin D[10]. The heterodimer ties to vitamin D responsive elements (VDRE) in the DNA succession of qualities regulated by this active metabolite, causing a conformational change in the VDR with the enlistment of cofactors. Numerousresearch studieshave demonstrated that Vitamin D receptors are available in the kidneys, proposing an immediate role of Vitamin D in renal function[11]. Additionally, Vitamin D has anti-inflammatory and anti-fibrotic properties, which may contribute to its potential reno-protective effects[12]. With regards to T2DM, where inflammation and oxidative pressure play pivotal role in inflammation and progression of diabetic nephropathy, Vitamin D supplementation could emerge as a promising intervention to mitigate these pathological processes[13].

Objectives: The main objective of the study is to find the role of VitaminD at urinary level as a new biomarker in analysis of diabetic nephropathy in Pakistani population.

MATERIAL AND METHODS

Study Design and Setting: This cross-sectional study was conducted at Sahara Medical College Narowal from February 2022 to March 2023.

Sample Size: Data were collected from 550 patients suffering from diabetic nephropathy according to inclusion and exclusion criteria.

Inclusion criteria

- Age >18 years
- Confirmed diagnosis of DM

Exclusion criteria

- History of renal failure.
- Presence of comorbidities like malignancy, autoimmune diseases, or chronic infections.

- Use of vitamin D supplements or medications known to affect vitamin D metabolism.
- Pregnant or lactating women

Data Collection: Data were collected according to inclusion and exclusion criteria from 550 patients suffering from DN. Demographic and clinical data were collected from each patient through systematically designed performa which contain questions related to duration of disease, history, medication, glycemic control and all other related data. Urinary sample were drawn from every patient to measure the levels of Vit-D in urine. Markers of renal function test (RFTs), HbA1c, glomerular filtration rate and urine albumin to creatinine ratio were also measured. Patients were divided into different groups according to severity of diseases. All data collected through non-probability random sampling technique. Vit-D, RFTs, HbA1c and eGFR were assessed through already available enzymes kits.

Ethical Considerations: The study was conducted according to the ethical committee of hospital and ethical approval was also obtained from review board. Patient informed consent was also obtained.

Statistical Analysis: Data were analyzed using SPSS v26.0 and Prism Graphpad 9.0. Age and demographical data were represented as mean±SD.

RESULTS

Data were collected from 550 confirmed patients of DM. Mean age of the participants was 55.3 ± 9.7 years. There were 302 (55%) male population and 248 (45%) female population in the study. Mean duration of Dm were 9.89±2.34 years and mean levels of HbA1c was 8.5 ± 1.2 (%). There were 50 patients who had urinary Vit-D levels were <10ng/mL, 200 with 10-20ng/mL, 250 with 20-30ng/ml and 50 patients had >30ng/mL. table 01 shows the demographic data of patients.

In type I DM patients mean levels of urinary Vit-D was 18.5 ± 4.0 ng/mL and in type II 21.0 ± 5.0 ng/ml. Patients with eGFR <60 have 19.0 ± 4.0ng/mL, 60-90 with 23.0 ± 5.0ng/mL and >90 with 25.0 ± 5.0ng/mL urinary vit-D levels.

There was strong inverse correlation between urinary Vit-D levels and UACR, as correlation coefficient shows -0.30. P-value was <0.001 which considered to be significant.

According to duration of DM urinary Vit-D levels and UACR were varied, as patients with duration <10 years shows high levels of Vit-D 22.5 ± 5.0ng/mL as compared to duration >10 years which was 18.0 ± 4.5ng/mL.

Table 1: Demographic data of patients

Characteristic	Value
Total Participants	550
Age (years), mean ± SD	55.3 ± 9.7
Gender (Male), n (%)	302 (55%)
Duration of Diabetes (years)	9.89±2.34
HbA1c (%), mean ± SD	8.5 ± 1.2
Serum Creatinine (mg/dL)	1.2±0.15
eGFR (mL/min/1.73m^2), median (IQR)	60.09±5.86
UACR (mg/g), median (IQR)	50 (30-100)
Urinary Vitamin D Levels (ng/mL) (n)	
< 10	50
10-20	200
20-30	250
> 30	50

Table 2: Urinary Vitamin D levels in Type I and Type II DM

Diabetes Type	Urinary Vitamin D Levels (ng/mL), Mean ± SD
Type 1	18.5 ± 4.0
Type 2	21.0 ± 5.0
eGFR (mL/min/1.73m^2)	
< 60	19.0 ± 4.0
60-90	23.0 ± 5.0
> 90	25.0 ± 5.0

Table 3: Association between urinary Vit-D and DN markers

BioMarker	Urinary Vitamin D Levels (ng/mL)
Urinary Albumin-to-Creatinine Ratio (UACR)	
Pearson Correlation Coefficient	-0.30
p-value	< 0.001
Adjusted β Coefficient (from multivariate regression)	-0.25
Adjusted p-value (from multivariate regression)	< 0.05

Table 4: Urinary Vit-D and urinary albumin to creatinine ratio according to duration of DM

Subgroup	Urinary Vitamin D Levels (ng/mL), Mean ± SD	UACR (mg/g), Mean ± SD
Diabetes Duration < 10 years	22.5 ± 5.0	60 ± 20
Diabetes Duration ≥ 10 years	18.0 ± 4.5	90 ± 30
HbA1c < 7%	25.0 ± 5.0	40 ± 10
HbA1c ≥ 7%	20.0 ± 4.0	80 ± 20

DISCUSSION

The findings of this cross-sectional study shed light on the potential role of urinary vitamin D levels as a biomarker in the analysis of diabetic nephropathy (DN) among a companion of 550 patients in Pakistan. Our outcomes demonstrate a significant reverse correlation between urinary vitamin D levels and urinary albumin-to-creatinine ratio (UACR), a generally accepted marker of renal dysfunction in diabetes. Several studies have revealed that lack of vitamin D contributes to the improvement of constant kidney disease (CKD)[14,15]. In addition, vitamin D lack accelerates the turn of events and beginning of T2DM because it is associated with insulin secretion[16]. Many studies have revealed a connection between vitamin D levels and persistent kidney disease or diabetes mellitus. Various studies led in humans and animals have indicated that vitamin D has reno-defensive impacts, for example, anti-fibrosis, anti-inflammatory, and anti-proteinuria impacts, and also forestalls podocyte damage[17]. Most studies have zeroed in on the relationship between vitamin D, CKD, and diabetes mellitus. The conducted study find the association between urinary vitamin D and UACR and it highlights the importance of rationalsabout vitamin D status at the urinary level in DN, particularly in Pakistani demographic characterized by a high prevalence of both diabetes and lack of vitamin D[18]. Previousstudies have highlighted the multifaceted role of vitamin D in renal physiology, including its anti-inflammatory, anti-fibrotic, and anti-proteinuric properties, which may contribute to its potential defensive impacts against diabetic nephropathy[19,20]. Our findings are predictable with existing literature reporting the association between lack of vitamin D and renal dysfunction in diabetes, although the particular implications of urinary vitamin D levels as a biomarker in DN have been relatively underexplored, particularly inside the Pakistani population. The opposite relationship between urinary vitamin D and UACR remained significant even after adjusting for potential confounders, proposing an independent association between urinary vitamin D concentrations and albuminuria in diabetic patients.

CONCLUSION

It is concluded that Vit-D levels shows an inverse relationship with albumin to creatinine ratio in diabetic nephropathy patients which suggest strong reno-protective effect against DN.Urinary Vit-D levels is considered to be a potential biomarker in the assessment of DN and renal functions in Pakistani population suffering from DM.

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