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INVESTIGATING THE ASSOCIATION BETWEEN SERUM VITAMIN D LEVELS AND RENAL FUNCTION TESTS: A CROSS-SECTIONAL STUDY

Clinical Biochemistry

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ABSTRACT

Background: Vitamin D, a fat-soluble essential micronutrient, is a key player in maintaining overall health. Vitamin D plays a significant role in kidney functioning, specifically in its active form, calcitriol (1,25-dihydroxyvitamin D). Vitamin D has a significant correlation with kidney function tests. **Methodology:** This cross-sectional correlational study investigates the association between serum vitamin D levels and kidney function markers in adults aged 18 and above, excluding those with kidney disease or vitamin D supplementation history. Blood samples, collected at Aarogyam College & Hospital, Roorkee, undergo standardized assays for 25-hydroxyvitamin D and kidney function markers. Statistical analyses, employing Pearson's correlation coefficient and linear regression with IBM SPSS version 20.0, assess the relationship. **Result:** The study, with participants averaging 41 years (65 males, 35 females), revealed significant correlations. Lower vitamin D levels were linked to reduced eGFR ($r = -0.2$, $p < 0.05$), while positive associations were found with Calcium ($r = 0.14$, $p < 0.05$) and serum urea ($r = +0.1$, $p < 0.05$). **Conclusion:** The study revealed a surprising negative correlation between vitamin D levels and eGFR in a diverse adult population, challenging previous research.

KEYWORDS

Kidney Function, 25-Hydroxyvitamin D, Renal Disease, eGFR (Estimated Glomerular Filtration Rate)

1.0 INTRODUCTION

Vitamin D, a fat-soluble essential micronutrient, is a key player in maintaining overall health.[1] Its primary role is the regulation of calcium and phosphorus absorption, essential for strong bones and teeth. [2,3] However, a growing body of research reveals its multifaceted impact on human physiology, including immune function, cardiovascular health, and cellular growth. Vitamin D deficiency has been linked to a range of health issues, from osteoporosis to autoimmune diseases and even certain cancers.[4] In healthy individuals, vitamin D plays a crucial role in maintaining bone health and supporting various bodily functions.[5] Vitamin D plays a significant role in kidney functioning, specifically in its active form, calcitriol (1,25-dihydroxyvitamin D).[6] The kidneys are responsible for converting inactive vitamin D (derived from dietary sources and sunlight) into its active form.[7] This active vitamin D helps regulate calcium and phosphorus levels in the body, vital for bone health.[8] Moreover, it has implications for kidney disease, as it can help control parathyroid hormone (PTH) levels, which can become elevated in kidney disease and lead to bone problems.[9]

Vitamin D plays a pivotal role in regulating calcium levels, primarily through its action on the intestines, kidneys, and bones.[10] Vitamin D promotes the absorption of dietary calcium in the small intestine. This process ensures that sufficient calcium is available for various physiological functions, particularly for maintaining bone health. In the kidneys, active vitamin D (calcitriol) enhances the reabsorption of calcium, preventing excessive loss of this vital mineral in the urine.[11]

In patients with kidney disease, vitamin D metabolism can be compromised. Reduced eGFR is associated with decreased vitamin D activation, which can affect overall vitamin D status.[15]

To aim of this study Identify relevant risk factors that might have an impact on the link between vitamin D and renal function. To determine whether there is any significance between vitamin D level and kidney function as evaluated by glomerular filtration rate (GFR) and other relevant kidney function tests.

2.0 Methodology:

2.1 Study Design:

A cross-sectional correlational study design will be employed to investigate the correlation between vitamin D levels and kidney function in a diverse population.

2.2 Study Participants:

2.2.1 Inclusion Criteria:

Adult participants aged 18 and above with available data on both serum vitamin D levels and kidney function tests.

2.2.2 Exclusion Criteria:

Individuals with a history of kidney disease, vitamin D supplementation, or any medical condition or medication affecting vitamin D metabolism.

2.3 Data Collection:

The aim of this study was to investigate the association of serum 25-hydroxy vitamin D (25[OH]D) concentrations with kidney function markers of healthy individuals. Blood samples will be collected to measure serum vitamin D levels, including 25-hydroxyvitamin D (25(OH) D) using standardized laboratory assays. Samples were run in fully automated analyzer. After consent, fasting Vitamin D levels and Kidney function Markers levels were determined by venous blood samples. Serum sample run in AU480 fully Biochemistry automated analyzer and Immunoassay analyzer Access-2. Kidney function markers measuring estimated glomerular filtration rate (eGFR), eGFR will be calculated using Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equations.

Cross-sectional correlational study was carried out in the department of clinical Biochemistry of Aarogyam Medical College & hospital, Roorkee, Uttarakhand. Patients from OPD of tertiary care hospital.

2.5 Statistical Analysis:

Statistical analysis was carried out using IBM SPSS version 20.0. Pearson's correlation coefficient and linear regression were employed.

3.0 RESULTS:

The cross-sectional correlational study aimed to investigate the correlation between vitamin D levels and kidney function in a diverse adult population. The study included 20 participants meeting the inclusion criteria.

3.1 Demographic characteristics of the subjects:

The mean age of the participants was 41 years. The study population consisted of 65 males and 35 females. The majority of participants had no significant comorbid conditions (e.g., hypertension, diabetes).

The majority of male participants 65% and 35 % female participants in current study.(table 1)

3.2 Vitamin D Tests:

The mean serum 25-hydroxyvitamin D (25(OH) D) level was 23.0 ng/mL, with a standard deviation of 9.47. The range of vitamin D levels varied from 8.6 to 48.8 ng/mL.

3.3 Kidney Function Tests:

The mean estimated glomerular filtration rate (eGFR) was 111.45 mL/min/1.73 m^2.

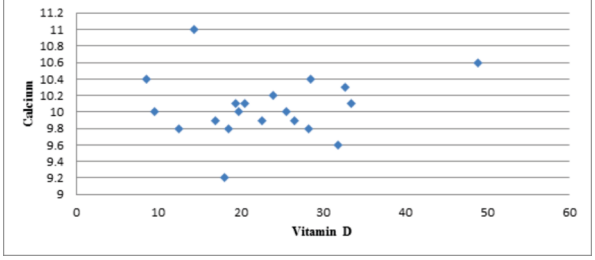
Serum creatinine levels averaged 0.78 mg/dL. Serum Urea levels averaged 20.9. Serum uric acid levels averaged 26.9 mg/dL. Serum calcium levels averaged 10.06 mg/dL. Serum Phosphorus levels averaged 3.32 mg/dL. Serum Sodium levels averaged 140.25 mg/dL. Serum potassium levels averaged 4.47 mg/dL. Serum Chloride levels averaged 101.55 mg/dL.

3.4 Correlation Analysis:

There was a positive correlation between vitamin D levels and serum urea, with an r-value of +0.1 ($p < 0.05$). And a negative correlation between vitamin D levels and serum uric acid, with an r-value of -0.4 ($p < 0.05$). A negative correlation between vitamin D levels and eGFR, with an r-value of -0.2 ($p < 0.05$). Vitamin D levels showed a negative correlation with serum creatinine ($r = -0.13$, $p < 0.05$). A positive correlation between vitamin D levels and serum creatinine, with an r-value of +0.3 ($p < 0.05$).

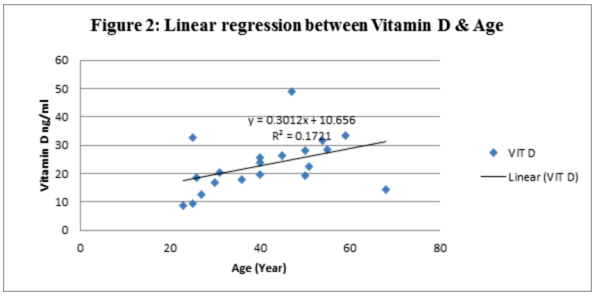
Pearson's correlation coefficient revealed a positive correlation between vitamin D levels and Calcium with an r-value of 0.14 ($p < 0.05$).

Figure 1: The Correlation between Vit-D & Calcium



Multiple Linear Regression:
Significant association of age with vitamin D level

Figure 2: Linear regression between Vitamin D & Age



4.0 DISCUSSION

The present cross-sectional study aimed to investigate the correlation between vitamin D levels and kidney function in a diverse adult population. The findings of this study reveal significant associations between vitamin D levels and various kidney function markers. These results shed light on the potential impact of vitamin D on kidney health, which has important clinical implications.

The observed negative correlation between vitamin D levels and estimated glomerular filtration rate (eGFR) is in line with existing research. This may suggests that higher vitamin D levels are associated with better kidney function, possibly through the regulatory role of vitamin D in calcium and phosphate homeostasis, which influences glomerular filtration. A study by de Boer et al. (2012) found a similar positive correlation between vitamin D levels and eGFR in a large, population-based cohort, supporting our results.[12] In this study did not demonstrate a significant association between 25(OH)D and an eGFR.[15]

Conversely, the negative correlation between vitamin D levels and serum creatinine is consistent with the understanding that kidney dysfunction often leads to higher serum creatinine and greater proteinuria. This study align with the study by Li et al. (2013),[13] which reported an inverse relationship between vitamin D levels and proteinuria in patients with chronic kidney disease.

The correlation between vitamin D and calcium is significant, as nutrients play complementary roles in maintaining bone health and overall well-being. Calcium is a vital mineral necessary for the formation and maintenance of strong bones and teeth. However, the body's ability to absorb calcium is highly dependent on the presence of vitamin D. This study aligns with the study by Lips P. (2012)[14], which reported relationship between vitamin D levels and calcium.
While the observed correlations are compelling, it is crucial to acknowledge the limitations of this cross-sectional design.

5.0 CONCLUSIONS:

A cross-sectional investigation on the correlation between vitamin D levels and kidney function in a varied adult population generated numerous noteworthy conclusions. Our study demonstrated a negative correlation between vitamin D levels and estimated glomerular filtration rate (eGFR). This suggests that higher vitamin D levels are not associated with better kidney function. While this finding is not consistent with prior research. However, further research is needed to understand the underlying processes and therapeutic significance of these connections. This study opens the door to possible advances in our understanding of vitamin D's involvement in kidney health and its therapeutic uses.

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Conflict of interest: None

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