ISSN: 0975-3583, 0976-2833 VOL15, ISSUE1, 2024

A CROSS SECTIONAL STUDY OF SERUM VITAMIN D AND SERUM URIC ACID LEVEL IN A TERTIARY CARE HOSPITAL, MALDA,WEST BENGAL, INDIA

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ABSTRACT:

Background: Vitamin D is usually consider as an important prohormone, which regulated the metabolism of calcium, phosphate and bone physiology. Serum uric acid (SUA) is the end product of purine metabolism in humans and uric acid is an independent risk factor for insulin resistance, cardiovascular disease (CVD), non-alcoholic fatty liver disease (NAFLD), type 2 diabetes mellitus, metabolic syndrome and atherosclerosis syndrome. However, the relationship between serum uric acid (SUA) and 25 (OH) D is still unclear in our population based study.

Methods: The cross sectional study was conducted in department of biochemistry of Malda Medical College and Hospital, 100 consecutive patients were enrolled over a period six months after obtaining institutional ethical clearance. Serum Vitamin D level was analyzed by Siemens ADVIA centaur, standardized against ID-LC/MS/MS, as per vitamin D standardization. Serum uric acid was estimated by Uricase method.

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Results: The level of 25 (OH) D was higher in hyperuricemic than in normouricemic female and male subjects (t value=-8.4, *p* value =<0.001 & t value=-4.6, p value= <0.001. Furthermore, 25(OH) D was positively correlated with serum uric acid, (correlation coefficient 7.3 *p* value= <0.001)

Conclusions: Our findings revealed that serum uric acid was positively associated with 25 (OH) D, higher levels of serum 25 (OH) D may be a potential predictor of hyperuricemia.

Keywords: Uric acid, Vitamin D, hyperuricemia,

Introduction:

Vitamin D is an important essential fat-soluble vitamin and it can be produced in the skin when the epidermis is exposed to ultraviolet radiation or it can be attained from the diet, including ergocalciferol (D_2) from plants and cholecalciferol (D_3) substantially from marine life. The primary source of vitamin D is the keratinocytes of the skin[1]. Vitamin D is actuated by hydroxylases, videlicet forms of cytochrome P450, to come the active hormone (1, 25 (OH) 2D). As 25(OH) D has a significantly longer half- life than 1, 25(OH) 2D, the serum position of 25(OH) D is considered to be the most stable and dependable index of vitamin D status.

Vitamin D is usually considered as an important prohormone, which regulated the metabolism of calcium, phosphate and bone physiology. Lately, an adding number of studies have shown that vitamin D is also involved in numerous other conditions. Through its nowhere expressed receptor, calcitriol displays potent anti-angiogenic and anti-inflammatory activity. The vitamin D metabolite can change DNA through vitamin D receptors (VDRs), heterodimerized with retinoic X receptors, which bind to the regulatory region in target

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genes[2]. The result of the metabolism of purines in humans is serum uric acid (SUA). The kidneys readily filter the majority of circulating uric acid (UA), eliminating between 60 -70 percent of the body's total UA[3]. Due to antioxidant properties of UA, Ames et al. proposed more than 30 years ago that increased SUA levels may have been beneficial during hominoid evolution[4]. Conversely, UA excess can result in gout and nephrolithiasis and moreover it has been suggested to be connected to many other human diseases [5]. Insulin resistance, cardiovascular disease (CVD), non-alcoholic fatty liver disease (NAFLD), type 2 diabetes mellitus, metabolic syndrome and atherosclerosis are independent risk factors for UA[6,7 8,9]. Reduced renal excretion caused by impaired renal function can raise the levels of uric acid in the serum[10]. In patients suffering from chronic kidney disease (CKD), a decline in 1, 25(OH) 2D levels has been related to decreased nephron mass and/or 1-α hydroxylase enzyme activity[11]. According to earlier research, vitamin D insufficiency was linked to chronic kidney disease[12]. Among postmenopausal Chinese Han women, vitamin D deficiency was found to be substantially correlated with elevated UA [13]. According to another study, individuals with type 2 diabetes mellitus and chronic kidney disease (CKD) are more likely to have lower vitamin D levels when their serum uric acid concentrations are lower. However, there weren't much research on uric acid and vitamin D in the general population[14]. The objective we set for carrying out this study was to delve into the connection between serum uric acid and 25(OH) D in the general population.

Materials and Methods:

This is a cross sectional study was conducted in department of biochemistry of Malda Medical College and Hospital, Malda, West Bengal from April 2022 to September 2022. 100 consecutive patients were enrolled for the study after obtaining ethical clearance from institutional Ethics Committee. Patients with history of renal, cardiac, hepatic diseases,

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pregnant women, drug addicts were excluded from the study. Among them 58 were female and 42 were male. 5 mL of venous blood was collected in the morning for vitamin D and serum uric acid estimation. Vitamin D level was analyzed on Siemens ADVIA centaur, standardized against ID-LC/MS/MS, as per vitamin D standardization. Serum uric acid was estimated by uricase method. Hyperuricemia was defined as SUA level >416.4 micromole/mL (>7 mg/dl) in male and >356.9 micromole/mL (>6 mg/dl) in female. All participants were divided into 2 group hyperuricemic and normouricemic.

Ethical Statement:

All participant provided written informed consent and they agreed to participate in this study. The protocol was approved by the institutional Ethics Committee for Research, The study was also conducted using good clinical practice following the Declaration of Helsinki.

Statistical analysis:

Data were entered in MS EXCEL 2007 version and further analysis was done by SPSS -2020. The categorical variables were analyzed by using frequency and percentage and continuous variable were analyzed by calculating mean ± SD. The numerical data were analyzed by using paired 't' test. Pearson correlation coefficient was used and p value ≤ 0.05 were considered as statistically significant.

Result:

In our study population 58 were female and 42 were male.

Table 1: Shows comparison of serum vitamin D (nmol/L) value in hyperuricemic and normouricemic female subjects.

	Mean	**Standard deviation**	**t value**	**P value**
Normouricemic female	18.5	4.3	-8.4	<0.001
Hyperuricemic female	29.4	5.5		

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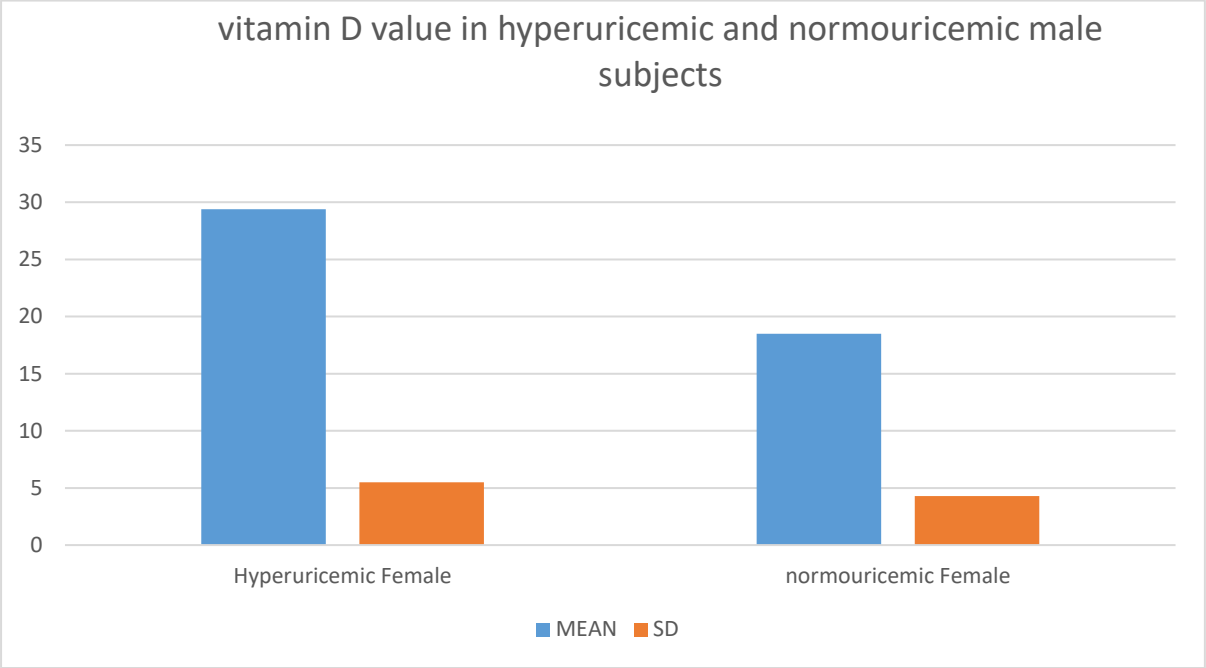
Figure 1: Composite bar diagram showing the mean and standard deviation (S.D.) of the serum vitamin D in hyperuricemic and normouricemic female subjects.



Serum vitamin D level was considerably high in hyperuricemic female compare with normouricemic female (table 1 & figure 1)

Table 2: Shows comparison of serum vitamin D value (nmol/L) in hyperuricemic and normouricemic Male subjects.

	Mean	**Standard deviation**	**T value**	**P value**
Hyperuricemic male	28.13	5.9	-4.6	<0.001
Normouricemic male	20.25	4.7		

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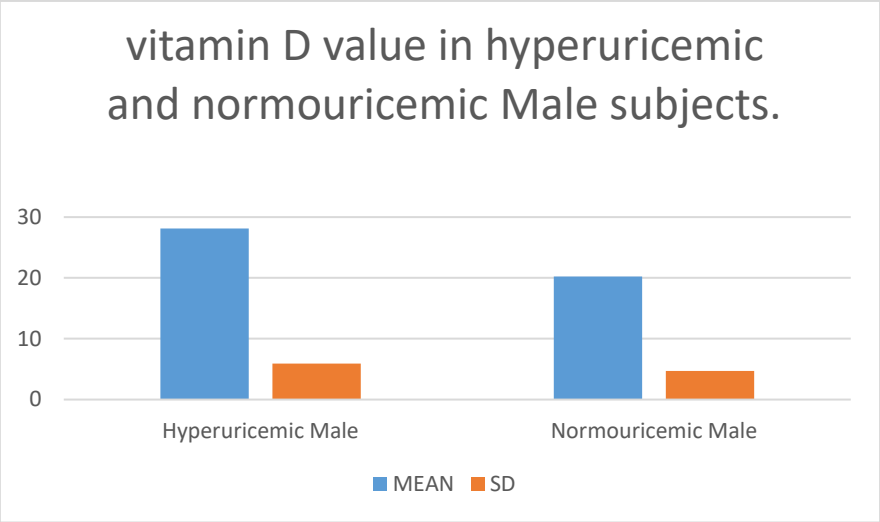
Figure 2: Composite bar diagram showing the mean and standard deviation (S.D.) of theof serum vitamin D in hyperuricemic and normouricemic female subjects.



Serum vitamin D level was also significantly high in hyperuricemic female compare with normouricemic female (table 2 & picture 2)

Table 3: Shows correlation between serum vitamin D and serum uric acids

Parameter	Correlation coefficient	P value
serum vitamin D and serum uric acids	0.73	<0.001

Figure 3: Scatter diagram shows correlation between serum vitamin D and serum uric acids

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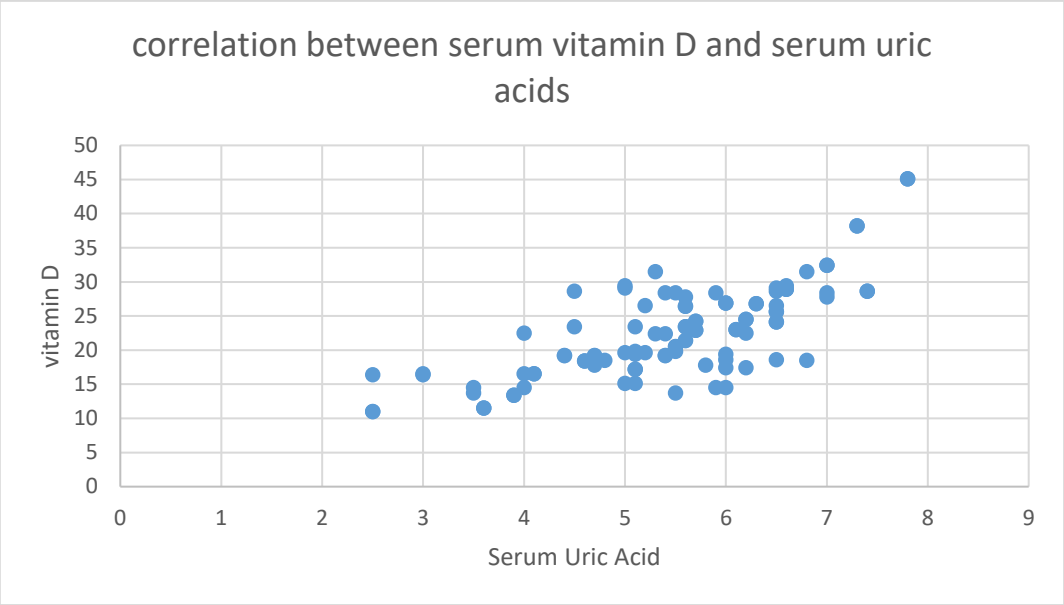

Considering the correlation between Serum vitamin D level and serum uric acid, serum vitamin D positively correlates with serum uric acid (table 3 & picture 3)

Discussion:

We performed cross sectional study was conducted in department of biochemistry of Malda Medical College. The level of 25(OH) D was higher in hyperuricemic than in normouricemic female and male subjects (t value=-8.4, *p* value =<0.001 & t value=-4.6, *p* value=<0.001. Furthermore, 25(OH) D was positively correlated with serum uric acid, (correlation coefficient 7.3 p value= <0.001). The conclusions of some other studies were analogous to our study by Sipahi S etal. set up that a drop in SUA was among the predictors of hypo vitaminosis D [14]. Still, several former studies have concluded that serum uric acid is associated with hypovitaminosis D [13, 15, 16]. This finding seems to indicate a complicated relationship between vitamin D status and SUA.

Vitamin D produced in the skin or attained from the diet should suffer two way of metabolic activation to come the active hormone (1, 25(OH) 2D). The first step, which results in 25- hydroxylated vitamin D, is conducted substantially in the liver by hydroxylases. In the rotation, 25(OH) D is bound to vitamin D- binding protein (DBP). The coming hydroxylation occurs after the complexes of 25(OH) D and DBP are reabsorbed from the glomerular filtrate

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at the proximal tubule of the kidney. The product of 1, 25 (OH) 2D is regulated by specific hormones on the expression of CYP27B1 and CYP24A1. CYP27B1 activates vitamin D metabolites, while CYP24 A1 (24- hydroxylase enzyme) inactivates both 25 (OH) D and 1,25 (OH) 2D, therefore maintaining calcium and phosphate homeostasis [2]. The effect of vitamin D is far more expansive. The nonskeletal functions indicated that vitamin D was involved in a wide variety of pathologic processes. Some studies have reported that tube 25(OH) D is associated with metabolic syndrome [17] also, vitamin D controls multiple natural processes, similar as the following cellular growth; angiogenesis [18] and cardiovascular system [19], isolation of keratinocytes [1]; and inhibition of the proliferation of bone [20], colon [21] and prostate cancer cells [22]. A high level of uric acid is considered to be associated with decreased renal function [23] and gouty arthritis [24]. Also, hyper uricemia may increase the threat of some conditions, similar as CVD [25] or insulin resistance [26]. On the other hand, UA is a strong antioxidant. Nabipour I et al. set up that a high concentration of UA was appreciatively linked with advanced bone mineral density (BMD) at all cadaverous spots, serum calcium and 25 (OH) D, as well as a lower frequency of fractures in aged male [27]. It's when liver function is compromised, both the product of UA and 25(OH) D decreases, because UA is produced in hepatocytes by xanthine oxidase, and vitamin D is hydroxylated in the liver to come 25 (OH).

Factors may affect the serum Uric acids and 25 (OH) D situations, similar as sun exposure, vitamin D supplementation, and the use of certain medications. Elevated parathyroid hormone (PTH) situations are allowed to decrease renal urate elimination, although the exact medium remains unclear [31]. It was set up that teriparatide remedy increased prevalence of hyperuricemia in postmenopausal women [32]. Serum uric acid position returned to the pre-treatment position after stopping treatment of PTH [33]. On the other hand,

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PTH can induce the expression of CYP27B1 and inhibit CYP24A1, as a result, the product of 1, 25 (OH) 2D increases [2]. Thus, hyperparathyroidism or PTH relief can impact both serum uric acid and vitamin D. UA is originally filtered in the kidney. Acute renal failure is associated with increased circulating SUA attention as a drop of renal excretion [10]. Reduced nephron mass and/ or 1α- hydroxylase enzyme exertion has been shown to be associated with a decline in 1, 25 (OH) 2D situations in cases with CKD [11]. As the substrate of 1, 25 (OH) 2D, situations of 25 (OH) D might be increased. Chen W et al. set up that hyperuricemia suppresses 1α- hydroxylase, leading to lower 1, 25 (OH) 2D and advanced PTH in rats [30]. Even so, 25-hydroxylase in the liver converts vitamin D to 25(OH) D. According to certain research, treating hyperuricemia results in an increase in 1, 25(OH) 2D conditions but keeping 25(OH) D unchanged [16, 34, 35.] Only the serum 25 (OH) D concentration was assessed in the present study to reflect the vitamin D status. Therefore, bloodied renal function may concurrently result in elevated serum uric acid and 25(OH) D level.

Our study has several limitations that must be considered. First, we didn't consider seasonal variation in 25 (OH) D attention. Second, data on sun exposure weren't available. Third, we didn't measure serum calcium and parathyroid hormone, and we couldn't determine whether the association of 25 (OH) D with serum uric acid was partly mediated by calcium or secondary hyperparathyroidism,

Conclusion:

Our findings revealed that serum uric acid was positively associated with 25(OH) D, higher levels of serum25 (OH) D may be a potential predictor of hyperuricemia.

Acknowledgements:

We appreciate the patients who participated in the study and their support. We also appreciate the assistance provided by the staffs of the biochemistry department's laboratory.

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Additionally, we are grateful to the Dean and Medical Superintendent of Malda Medical College and Hospital for their constant encouragement.

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