

Correlation of Vitamin D and Uric Acid among General Population of Sindh

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ABSTRACT

Objective: To study and correlate vitamin D and uric acid among general population of Sindh.

Study Design: Cross sectional study

Place and Duration of Study: This study was conducted at the Suleman Roshan Medical College, Tando Adam, Sindh from January 2020 to August 2021.

Materials and Methods: A sample of 700 normal healthy subjects of both genders was selected according to pre-determined criteria. Volunteers, age (40 – 60 years), both genders were inclusion criteria. Physical examination was performed, and blood samples were collected to estimate the vitamin D and serum uric acid. Data was analyzed using student t – test for continuous variables and Chi – square test for categorical variables. Pearson's correlation was used to determine correlation of vitamin D and uric acid. SPSS ver. 20 analyzed data variables at 95% confidence interval ($P \leq 0.05$).

Results: Vitamin D was found very low 27.05 ± 14.4 ng/dl in male and 15.7 ± 8.51 ng/dl in female ($P=0.0001$). High uric acid was noted in both male and female subjects; 7.60 ± 1.38 and 6.47 ± 2.36 mg/dl respectively ($P=0.0001$). Vitamin D deficiency and sufficiency was noted in 75.4% (14.4186 ± 5.1 ng/dl) and 24.5% (42.7 ± 4.1 ng/dl) ($P=0.0001$). Serum uric acid normal and high levels were found in 173 (24.7%) and 527 (75.2%) respectively ($P=0.0001$). Vitamin D shows significantly strong negative correlation with serum uric acid ($r=-0.852$, $p=0.0001$). Negative correlation of vitamin D and uric acid in male was ($r=-0.706$, $p=0.0001$) and in female ($r=-0.892$, $p=0.0001$).

Conclusion: The present study observed strong negative correlation of vitamin D and serum uric acid in normal adult healthy subjects.

Key Words: Vitamin D, Uric acid, Correlation, Sindh

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INTRODUCTION

Vitamin D deficiency and high serum uric acid have been linked with a number of metabolic disorders such as the diabetes mellitus (DM), metabolic syndrome, hyperlipidemia and hypercholesterolemia, and coronary artery disease. Hyperlipidemia and hypercholesterolemia are one of the major risk factors of cardiac diseases.¹⁻³

Currently, vitamin D deficiency and high serum uric acid levels in general population have been reported from different parts of the country.^{2,3} High blood uric acid levels causes depositions of uric acid crystals in soft tissues organs and joints such as kidneys leading to the development of urate – nephropathy and gout.^{4,5} High plasma uric acid leads to the urate crystals formation in different tissues and organs for example in joints causing pain and arthritis. Gout, nephrolithiasis, urolithiasis, and nephropathy lead to joint – immobility, renal damage and systemic hypertension, urinary problems and metabolic syndrome.^{4,5} Besides increasing prevalence of high serum uric acid, the vitamin D deficiency has taken the epidemic shape that has resulted in various osseous and extra-osseous disorders. Vitamin D deficiency is considered an independent risk factor in different chronic metabolic and non - metabolic disorders.³ Globally, the vitamin D deficiency has become a public health problem of concern because of chronic diseases.⁵ Nowadays, the vitamin D deficiency is observed in sunny areas and countries with much exposure to sunlight beside cold weather countries.⁶ Similarly, the prevalence of high uric acid has been reported from countries all over the

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World.⁷ Casual correlation of vitamin D deficiency and high uric acid levels have been narrated in medical literature.⁵ Adverse effect of vitamin D deficiency on uric acid metabolism has been found in different genetic studies.^{1,8} Link of vitamin D and high uric acid has been found at the level of 1 α -hydroxylase enzyme. Increased uric acid levels in circulation suppress the 1 α -hydroxylase enzyme thus interferes with the vitamin D hydroxylation.⁵ Genomic studies have suggested link of high uric acid with vitamin D metabolism through gene stimulation.⁹ Uric acid lowering agent allopurinol therapy increased the plasma vitamin D hydroxylation has been suggested.^{1,3} Globally, the vitamin D insufficiency and deficiency has become a major public health concern in these days.^{6,9} The present study was conducted to analyze the vitamin D and serum uric acid levels in general population of Sindh and their casual association with each other to reach to a proper conclusion as the data is lacking at national level in our country. Therefore, it is important to explore the vitamin D and uric acid in general population of Sindh and their association with each other to make future planning to overcome the related public health problem.

MATERIALS AND METHODS

The present cross – sectional study analyze and correlate vitamin D and serum uric acid in general healthy adult population of Sindh. The study collected sample from different cities of Sindh. The data pool was gathered at the Suleman Roshan Medical College Hospital for final analysis and correlation of research variables. We recruited a sample of 700 normal healthy subjects of both genders of equal number. Data was collected according to pre – determined criteria; volunteers, age (40 – 60 years), healthy adults of both genders were inclusion criteria. Multi vitamin supplementation, pregnancy and breast feeding mothers were strictly excluded. Patients taking anti – hypertensive drug therapy such as angiotensin inhibitors and thiazide diuretics and anti – epileptic drugs were excluded. Any person taking uric acid lowering pill was also exclusion criteria. Of major exclusion criteria were unhealthy adult subjects. Permission was sought from the research ethics committee approved the institute. Volunteers were negotiated of the purpose of study, data and blood sampling. All volunteers thorough clinical history and physical examination. Volunteers were informed of no monetary harm or benefit to them and no expenses of laboratory investigations. Volunteers have been informed that they can leave at any time if they are concerned or indicate the reason. Blood samples were collected to estimate the vitamin D and serum uric acid. Blood was centrifuged to get sera at 3000 rpm (15 minutes) and kept in pre – labeled tubes. Sera were stored at -20 °C until analysis of vitamin D and uric acid. Immunofluorescence assay (VIDAS-Biomerieux-

diagnostics) was employed for vitamin D detection. While serum uric acid was detected by uricase enzymatic method. Samples were run on Roche Cobas auto-analyzer. Vitamin D <29.9 ng/dl was defined as deficiency and >30.0 ng/dl as sufficiency.¹⁰ High serum uric acid was defined as >7.0 mg/dl for male and >5.8 mg/dl for female.¹¹ Data was analyzed using student t – test for continuous variables and Chi – square test for categorical variables. Pearson`s correlation was used to determine correlation of vitamin D and uric acid. Scatter plots were generated on Microsoft Excel Sheet. SPSS ver. 20 analyzed data variables at 95% confidence interval (P≤0.05).

RESULTS

Age of male and female study sample was 52.15±7.7 and 53.47±5.8 years (P=0.91). Findings are shown in table – 1. Vitamin D was found very low approximately 27.05±14.4 ng/dl in male and 15.7±8.51 ng/dl in female (P=0.0001). High uric acid was noted in both male and female subjects; 7.60±1.38 and 6.47±2.36 mg/dl respectively (P=0.0001). Vitamin D deficiency and sufficiency was noted in 75.4% (14.4186±5.1 ng/dl) and 24.5% (42.7±4.1 ng/dl) of total sample size (P=0.0001) (table - 2).

Table No.1: Findings in study groups

	Male	Female	P-value
Age (years)	52.15±7.7	53.47±5.8	0.91
Body weight (Kg)	76.2±11.3	76.7±11.1	0.56
Systolic BP (mmHg)	121.2±6.7	120.8±5.3	0.78
Diastolic BP (mmHg)	79.7±15.2	78.9±0.18	0.45
S. Creatinine (mg)	0.91±0.11	0.95±0.21	0.007
Vitamin D (ng/dl)	27.05±14.4	15.7±8.51	0.0001
Uric acid (mg/dl)	7.60±1.38	6.47±2.36	0.0001

Table No.2: Vitamin D status of study sample

Vitamin D (ng/dl)	N (%)	Mean	Std. Dev.	P-value
Deficiency	528 (75.4%)	14.4186	5.15573	0.0001
Sufficiency	172 (24.5%)	42.7442	4.12151	

Table No.3: Vitamin D status of subjects with normal & high serum uric acid

Uric acid	Vitamin D (ng/dl)			P-value
	N (%)	Mean	Std. Dev.	
Normal	173 (24.7%)	42.2601	5.63280	0.0001
High	527 (75.2%)	14.5237	5.40234	

Subjects with high serum uric acid level (75.2%) showed severe vitamin D deficiency (14.52±5.4 ng/dl)

and sufficient vitamin D in those with normal serum uric acid (42.26 ± 5.63 ng/dl) ($P=0.0001$) (table - 3). Vitamin D shows strong negative correlation with serum uric acid ($r=-0.852$, $p=0.0001$) in total study sample. Negative correlation of vitamin D and uric acid in male was ($r=-0.706$, $p=0.0001$) and in female ($r=-0.892$, $p=0.0001$) (table - 4).

Table No.4: Pearson`s correlation output

Vitamin D	Uric acid		
	r-value	N	P
Female	-0.706**	350	0.0001
Male	-0.892**	350	0.0001
Total sample	-0.852**	700	0.0001

** . Correlation is significant at the 0.01 level (2-tailed)

DISCUSSION

The present cross sectional study was conducted at a Suleman Roshan Medical College Hospital Tando Adam. Data was also collected from other medical hospitals and centers located in different cities of Sindh. Age of male and female study sample was 52.15 ± 7.7 and 53.47 ± 5.8 years ($P=0.91$). Study sample of present study comprised older age subjects; however, the findings are in agreement with previous studies.^{1,2,5,8} Vitamin D was found very low approximately 27.05 ± 14.4 ng/dl in male and 15.7 ± 8.51 ng/dl in female ($P=0.0001$). High uric acid was noted in both male and female subjects; 7.60 ± 1.38 and 6.47 ± 2.36 mg/dl respectively ($P=0.0001$). The findings are supported by previous studies.^{1,2,5} Vitamin D is an essential micronutrient that plays vital role in bone and body health, and boosts the immune reactions and prevents the chronic metabolic diseases. Vitamin D deficiency has become a public health problem throughout the World and its occurrence is observed in normal health persons as well as those with systemic diseases. Vitamin D deficiency is observed in studies from tropical countries with sunlight exposure, reason remains unknown.¹² Vitamin D deficiency and sufficiency was noted in 75.4% (14.4186 ± 5.1 ng/dl) and 24.5% (42.7 ± 4.1 ng/dl) of total sample size ($P=0.0001$). Subjects with high serum uric acid level (75.2%) showed severe vitamin D deficiency (14.52 ± 5.4 ng/dl) and sufficient vitamin D in those with normal serum uric acid (42.26 ± 5.63 ng/dl) ($P=0.0001$). High serum uric acid is highly prevalent in normal populations of developed and developing countries.¹³ High uric acid damages joints by forming urate crystals and becomes deposited in the microvasculature, leading to nephropathy, tophi and hypertension.³ Vitamin D deficiency with high serum uric acid is potential health risk factors and this has been observed in the present study. High serum uric acid has been observed in the general populations of developed and developing countries.^{1,14} Negative correlation of vitamin D and uric acid in male was ($r=-0.706$, $p=0.0001$) and in female

($r=-0.892$, $p=0.0001$). In present study, the vitamin D deficiency was noted in 75.4% and high serum uric acid level in 75.2% that proved vitamin D deficient. The findings are in keeping with previous studies.^{1,15} Vitamin D sufficiency was found in 24.5% (42.7 ± 4.1 ng/dl) of total sample size ($P=0.0001$) that is in line with a recent study by Najeeb et al¹ that found sufficient vitamin D in 20% of sample subjects in their study. The findings are supported by above study. Subjects with sufficient vitamin D have had normal serum uric acid and vice versa. In present study, we observed vitamin D shows strong negative correlation with serum uric acid ($r=-0.852$, $p=0.0001$) in our study sample. The findings are supported by previous studies.^{1,15,16} Vitamin D deficiency has been linked with a number of communicable and non – communicable diseases and likelihood of its deficiency with high serum uric acid is reported by a previous study.¹⁸ Vitamin D supplementation reduced serum uric acid levels, has been demonstrated by a previous study.¹⁹ Some of studies had reported genomic link of vitamin D deficiency and uric acid levels.^{20,21} Pearson`s correlation of vitamin D and uric acid showed strongly negative correlation (table – 4) indicating a causal relationship that needs further research with large sample size using genomic methods. Inverse correlation of vitamin D and uric acid is consistent with previous studies.^{5,13}

CONCLUSION

Normal vitamin D is essential for healthy bone and body. We found, vitamin D deficiency in 75.4% of sample size. High serum uric acid level was found in 75.2% with severe vitamin D deficiency. Significantly negative correlation was found between vitamin D deficiency and serum uric acid. Further studies are demanding to involve large sample size in indigenous population to investigate the correlation to make strategies for the preventable cause of morbidity and mortality.

Author's Contribution:

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Conflict of Interest: The study has no conflict of interest to declare by any author.

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