

Association between Vitamin D level and metabolic disturbances in north Indian PCOS women

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Abstract

Introduction: Polycystic ovarian syndrome (PCOS) is most common endocrinopathy in reproductive age women. Vitamin D deficiency is shown in 85% of patients with PCOS from developed countries. Aim of the present study was to compare vitamin D status in women with PCOS versus fertile women and subsequently evaluate the association between vitamin D status and metabolic disturbances in PCOS. **Material and methods:** In this case control study 80 participants (40 case and 40 control) enrolled aged between 18-40 years affected by PCOS as defined by Rotterdam Criteria 2003. The patients were divided in to three groups as per vitamin D deficiency - deficient, insufficient and sufficient. The BMI (body mass index) was measured by dividing the weight in kilogram by the square of body height. In this study serum vitamin D level 8-20ng/ml was classified as insufficient and vitamin D level <8ng/ml was classified as deficient. **Result:** In this study, almost 76.3% of the cases were sufficient and 22.5% of the cases were insufficient. Around 1.3 % cases with vitamin D deficiency were noted. The average vitamin D 27.43ng/ml with standard deviation 9.894 and the minimum and maximum vitamin D was 7 and 49 ng/ml respectively. Comparison of vitamin D deficiency between case and control, after comparison t- test shows significant difference (p value <0.05). The insufficient case are significantly higher in case (42.5%) compared to control (2.5 %). It is also noted that the sufficient case are significantly lower in case (55.0%) compared to control (97.5%). **Conclusion:** Vitamin D level was found to be lower in PCOS women than normal women and also finds association between vitamin D and metabolic disturbances in PCOS cases. High BP and blood sugar was associated with low vitamin D level, however no association was found with BMI and dyslipidaemia.

Key words: Polycystic ovary syndrome, vitamin D, metabolic disturbance, dyslipidaemia, BMI.

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Introduction

Polycystic ovarian syndrome (PCOS) is most common endocrinopathy in reproductive age women. Depending on the diagnostic criteria used the prevalence of PCOS is 10%, which is characterized by ovulatory dysfunction, hyperandrogenism and polycystic ovarian morphology [1,2]. Most of the women diagnosed with PCOS suffer from metabolic disturbance i.e, 30-40% have impaired glucose tolerance test (GTT) and insulin resistance (IR) with compensatory hyperinsulinemia and as many as 10% will develop type 2 diabetes mellitus during their fourth decade[3]. Insulin resistance in women with PCOS has been contributed to adipose tissue dysfunction. However, a substantial number of lean women affected by PCOS have insulin resistance as well, independent of obesity [4,5]. PCOS have the indications of reproductive defects, including insulin resistance; in addition, they are at a higher risk of type 2 diabetes mellitus, high blood pressure, low HDL, high LDL, depression, and anxiety [6].

The Rotterdam criteria are highly accepted for the diagnosis of PCOS, with this disease being diagnosed typically in women who

show at least two of the three symptoms of I; oligo or anovulation, II; hyperandrogenemia, and III; polycysts in the ovaries on ultrasonography [7].

Vitamin D is a fat soluble vitamin. serum 25(OH)D is the major circulating form of vitamin D and is used as the main indicator of vitamin D status.its half-life is 2-3 week compared to only 4-6 hours for 1,25(OH)2D(8).since many years, a role for vitamin D has been suggested outside the calcium and bone homeostasis, due to the identification of the VDR, and the enzyme 1- α -hydroxylase in many more tissue, including the pancreatic β -cells, immune cell [9] , and reproductive organs in both genders[7] . Moreover, the assumption is supported by the finding that the active vitamin D-Vitamin D receptor complex regulate over 300 genes, including genes that are important for glucose and lipid metabolism as well gonadal function[8] .some observational studies have demonstrated a link between vitamin D deficiency and the onset of progression of type 2 diabetes [11-14] . Furthermore, low vitamin D status is associated with macrovascular events in patients with type 2 diabetes mellitus [15]. This association may be the result of the link between vitamin D status and rennin-angiotensin system[16], endothelial function (160, blood pressure [17] or chronic inflammation [18]. Women with vitamin D status and metabolic disturbances have been investigated in various studies. However, due to the heterogeneity of the studies, small sample sizes and small number of studies no definite

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conclusion could be drawn [19]. Various observational studies in the past have confirmed the association between vitamin D and insulin resistance in patient with type 2 diabetes and have concluded that vitamin D deficiency is inversely related to the degree of IR [20]. Until now there are no clear recommendation regarding vitamin D deficiency as a risk factor for PCOS and its association with metabolic disturbances in PCOS women. Hence we concluded this study to evaluate the vitamin D status in PCOS women and fertile women and its association with metabolic disturbances in PCOS women.

Material and methods

Study Participant

This case-control study was conducted in Department of Obstetrics and Gynaecology, Dr. Ram Manohar Lohia Institute of Medical Sciences hospital, Lucknow, after ethical clearance. Written informed consent was obtained from all patients. In this study 80 participants (40 case and 40 control) enrolled aged between 18-40 years affected by PCOS as defined by Rotterdam Criteria 2003. The exclusion criteria were any diagnosed case of PCOS who was any history of taking vitamin D and calcium supplements within three months ago, history of medical or surgical illnesses and women illness with any endocrine disorder such as thyroid, parathyroid, DM, Cushing's syndrome, CAH, hyperprolactinemia. The patients were divided into three groups as per vitamin D deficiency - deficient, insufficient and sufficient

Data collection

PCOS was diagnosed by Rotterdam's criteria. The BMI (body mass index) was measured by dividing the weight in kilogram by the square of body height. Blood pressure was also taken at the time of enrolment. Blood sample was taken from peripheral blood after

overnight fast to measure serum levels of vitamin D, GTT (2-hour-75gm glucose) and lipid profile, all estimation was done by standard hospital protocol. In this present study serum vitamin D level 8-20ng/ml was classified as insufficient and vitamin D level <8ng/ml was classified as deficient.

Statistical analysis

Data were analyzed using SPSS 21.0 and continuous variables were summarized as mean ± SD or median with interquartile range. Independent sample t test was used for comparison of mean among two groups or corresponding non-parametric Mann Whitney U test was used. Categorical variable was summarized in term of frequency with % and was tested by using Chi square /Fisher exact test. For all test p value < 0.05 was considered as statistically significant.

Results

In this case control study table-1 shows 6.3% of the cases belong to the group up to 20 years and 30.0% of the cases belong to the 21-25 years. Around 43.8% of the cases belong to the age group 26-30 years and 20% of the cases belong to the group 31-35 years. The average age was 26.84 years with standard deviation 4.017. The minimum and maximum age was 18 and 34 years respectively.

Among 80 participants taken for the study, around 87.5% were normal and 12.5% were overweight. The average BMI was 22.3kg/m² with standard deviation 1.903. The minimum and maximum BMI was 19 and 27 kg/m² respectively. 95% of the participants have normal blood pressure and 5% has high blood pressure. Around 85% of the participants have normal blood sugar and 15% were high blood sugar. The average blood sugar was 123.8 mg/dL respectively. Among 80 participants, around 95% of the participants have normal lipid profile and 5% of the case has increased lipid profile.

Table 1: Demographic distributions

Parameters	Frequency	Percentage (%)
Age (years)		
Up to 20	5	6.3%
21-25	24	30.0%
26-30	35	43.8%
31-35	16	20.0%
BMI		
Normal	70	87.5%
Overweight	10	12.5%
Blood pressure		
Normal	76	95.0%
High	4	5.0%
Blood sugar		
Normal	68	85.0%
High	12	15.0%
Lipid profile		
Normal	76	95%
Abnormal	4	5.0%

In this study, almost 76.3% of the cases were sufficient and 22.5% of the cases were insufficient. Around 1.3% cases with vitamin D deficiency were noted. The average vitamin D 27.43ng/ml with standard deviation 9.894. The minimum and maximum vitamin D was 7 and 49 ng/ml respectively. Comparison of vitamin D deficiency between case and control, after comparison t- test shows significant difference (p value <0.05). The insufficient case are significantly higher in case (42.5%) compared to control (2.5%). It is also noted that the sufficient case are significantly lower in case (55.0%) compared to control (97.5%).

Table 2: Comparison of vitamin D Deficiency between Case and Control

Vitamin Deficiency	Case (N=40)	Control (N=40)	Total (N=80)	p-value
Deficient	1(2.5%)	0(0.0%)	1(1.3%)	0.000*
Insufficient	17(42.5%)	1(2.5%)	18(22.5%)	
Sufficient	22(55.0%)	39(97.5%)	61(76.3%)	
Mean± SD	20.6±7.86	34.3±6.34	27.4±9.89	

*P value <0.05 = statistically significant

In this study table 3 shows the association between vitamin D deficiency and BMI is not significant (p<0.05) i.e., no significant

association between vitamin D deficiency and BMI in PCOD. Table 3 also shows an insufficient case was higher than overweight cases

(57.1) as compared to normal weight case (39.4%) and statistically not significant found ($p=0.076$).

Association between Vitamin D deficiency and blood sugar were statistically significant in PCOD cases ($p=0.028$). Table 3 shows that the insufficient cases was higher blood sugar (66.7%) as compared to normal cases (38.2%) and also shows statistically significant ($p=0.024$) association between vitamin D and blood pressure in

PCOD, were the insufficient cases (100%) are higher than normal case (36.1%),

Association between Vitamin D deficiency and lipid profile in PCOD was statistically not significant, table 3 revealed that the sufficient case are significantly higher lipid profile (56.8%) as compared to normal cases (33.3%) were p value >0.05 i.e. statistically not significant ($p=0.062$).

Table 3: Comparison of vitamin D Deficiency between metabolic parameter parameters in PCOD cases

S.No.	Parameters	Vitamin D Deficiency			Total	p-value
		Deficient	Insufficient	Sufficient		
1.	BMI					0.076
	Normal	0(0.0%)	13(39.4%)	20(60.6%)	33	
	Overweight	1(14.3%)	4(57.1%)	2(28.6%)	7	
	Total	1(2.5%)	17(42.5%)	22(55.0%)	40	
2.	Blood Pressure					0.024*
	Normal	1(2.8%)	13(36.1%)	22(61.1%)	36	
	High	0(0.0%)	4(100.0%)	0(0.0%)	4	
	Total	1(2.5%)	17(42.5%)	22(55.0%)	40	
3.	Blood sugar					0.028*
	Normal	0(0.0%)	13(38.2%)	21(61.8%)	34	
	High	1(16.7%)	4(66.7%)	1(16.7%)	6	
	Total	1(2.5%)	17(42.5%)	22(55.0%)	40	
4.	Lipid profile					0.062
	Normal	0(0.0%)	16(43.2%)	21(56.8%)	37	
	High	1(33.3%)	1(33.3%)	1(33.3%)	3	
	Total	1(2.5%)	17(42.5%)	22(55.0%)	40	

*P value <0.05 = statistically significant

Discussion

Aim of the present study was to compare vitamin D status in women with PCOS versus fertile women and subsequently evaluate the association between vitamin D status and metabolic disturbances in PCOS. Vitamin D deficiency is shown in 85% of patients with PCOS from developed countries [20,21].

In this present study the difference in vitamin D deficiency between case and control was significant. Vitamin D insufficiency was more in PCOS in case then control Vitamin D insufficiency was found in 42% of PCOS patients and 2.5% of control and statistically significant (<0.05), some previous study found significant and similar to this study[22]. A previous study found insignificant result between two groups [23]. Present study found vitamin D was sufficient only in 55% of case where as 97% of control. Previously showed vitamin D level was found to be significantly lower in PCOS group as compare to control group[24]. A another study shown that 15.7% of patients had sufficient vitamin D levels and 84% had vitamin D3 level less than required [25], 46% of PCOS patients had vitamin D insufficiency, 40% had mild insufficiency and 4 had moderate deficiency were shown [26].

In this present study, the association between vitamin D deficiency and BMI was statistically not significant. Insufficient vitamin D level was higher in overweight case as compare to normal weight case. Similar to our study previously a study reported no statically correlation between vitamin D and BMI. In contrast to this study, a study previously showed PCOS patients with hypovitaminosis D had higher BMI than sufficient vitamin D level [27], another prospective observational study found that mean vitamin D level of overweight PCOS patients was lower than normal weight PCOS patients [26].

Present study showed significant association was found in association between vitamin D and BP in PCOS, also showed statistically significant association between vitamin D and Blood sugar in PCOS patients. No significant differences found [27].

In this present study there was no significant association between lipid profiles in PCOS patients; vitamin D sufficiency was found in 33% of dyslipidaemia PCOS patients and 43.2% of PCOS patients with normal lipid profiles. Similar to our study, previously showed hypovitaminosis is associated with low HDL. The HDL in PCOS

patients with vitamin D deficiency was 41.7% and body 48.3% in PCOD patients with normal vitamin D level [26]. A study showed significant correlation between vitamin D and IR predictability in both PCOS and control women there is a growing body of evidence suggesting an inverse association between vitamin D status and metabolic disturbances in PCOS. Nevertheless, normalization of vitamin D levels is recommended generally and especially for PCOS patients [28]. Previous study concluded IR and other metabolic abnormalities in PCOS women seem to be related to PCOS rather than vitamin D deficiency [29]. A study concluded that the vitamin D is inversely correlated with the total cholesterol, triglyceride, and other metabolic disturbance in PCOS patients [19].

The limitation of the study includes small sample size, lack vitamin D relation with IR, clinical and hormonal parameter. This study need to re investigate in large sample size.

Conclusion

This present study concluded that Vitamin D level was found to be lower in PCOS women than normal women and also find association between vitamin D and metabolic disturbances in PCOS cases. High BP and blood sugar was associated with low vitamin D level, however no association was found with BMI and dyslipidaemia. Hence it is speculated that correction of vitamin D in PCOS patient can alleviate various clinical features and metabolic disturbances associated with PCOS .there is need for routine vitamin D evaluation in PCOS patients especially with various metabolic disturbance to find the role of vitamin D in PCOS. There may be place or Vitamin D supplementation in PCOS patients to prevent long term complications, but current evidence is limited further studies are needed with large sample size to conform potential benefit of vitamin D .

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