

**Status of Vitamin D in Polycystic Ovary Syndrome: A Case Control Study**Shubhangi Raj<sup>1</sup>, Rajani Sinha<sup>2</sup>, Farhan Usmani<sup>3</sup>, Madhu Sinha<sup>4</sup><sup>1,2</sup>Postgraduate Student (Final Year), Department of Biochemistry, Patna Medical College, Patna, Bihar<sup>3</sup>Professor, Department of Biochemistry, Patna Medical College, Patna, Bihar<sup>4</sup>Professor and Head of Department, Department of Biochemistry, Patna Medical College, Patna, Bihar

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**Abstract:**

**Background:** Endocrine and metabolic abnormalities are clinical manifestations of PCOS, or polycystic ovarian syndrome. The lack of vitamin D in many people worldwide, regardless of age, has led to a significant increase in interest in the nutrient in recent years. This study compared and measured the vitamin D levels of healthy women and PCOS patients.

**Methods:** It was a case-control study. In this study, 75 PCOS patients and 75 age-matched healthy controls were enrolled. Using the ELISA technique, an immunoassay method was used to estimate the serum level of Vitamin D. When appropriate, the independent t-test and chi square test were used to compare the data.

**Results:** Compared to healthy controls (34.12±7.41 ng/ml), PCOS patients had a significantly ( $p < 0.0001$ ) lower total blood vitamin D level (21.91± 8.49 ng/ml).

**Conclusion:** The observation of hypovitaminosis D in PCOS cases suggested a potential role for vitamin D in the pathophysiological alterations associated with the illness.

**Keywords:** Polycystic Ovary Syndrome; Vitamin D; Calcitriol; Puberty.

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**Introduction**

The most prevalent cause of infertility in women is polycystic ovarian syndrome (PCOS), a heterogeneous endocrine condition that affects 4–11% of women of childbearing age. [1] An estimated 16% of girls with menstrual problems who visit a gynecological clinic receive a PCOS diagnosis. [2] This syndrome's cause is currently unknown. However, it is known that a genetic predisposition could have a unique impact on how it develops. One steroid-like fat-soluble molecule is vitamin D.

Cholecalciferol and ergocalciferol's biological activity is exclusively linked to the metabolism of phosphate and calcium. This means that they have a pleiotropic effect and influence on the functioning of several physiological systems, including the immunological, endocrine, neurological, and muscular systems. Studies on populations have revealed a significant vitamin D deficit in the general population.

Even 20–45% of individuals are concerned about this issue. [3-5] In 67–85% of women with PCOS, a vitamin D level below the cut-off threshold thought to represent the lower limit of normal is found. [6] Without a doubt, metabolic problems and hormone imbalances are linked to this. [7] There are reports that interpret vitamin D

deficiency as the missing link connecting PCOS with coexisting conditions such as insulin resistance, impaired glucose tolerance, and type 2 diabetes mellitus, despite the fact that the effect of vitamin D levels on hormonal and metabolic abnormalities in PCOS is still unknown.

**Material and Methods**

The study was a case control. 75 patients with polycystic ovarian syndrome who visited the gynecology outpatient department at Patna Medical College and Hospital, Patna, Bihar, between July 2022 and June 2023 were included in this study.

They were selected for the Case Group. Rotterdam's criteria<sup>13</sup> was used to diagnose PCOS, and patients who met two out of the three criteria: oligo- or anovulation, clinical and/or biochemical hyperandrogenism, and polycystic ovaries on ultrasound measurement were assigned to the PCOS group. A control group of seventy-five similarly aged and healthy women was chosen from among society volunteers and patient relatives.

Excluded from the study were patients with congenital adrenal hyperplasia, hyperprolactinemia, Cushing's syndrome, liver and renal disorders, diabetes mellitus, and other hormonal disorders

with similar clinical features. They were also not taking any medications, such as sex steroids, vitamin D and calcium supplements, insulin sensitizing agents, etc. Following an 8–12 hour overnight fast, blood samples were taken from both patients and controls in the early follicular phase. To get clear, non-haemolysed serum, 5 ml of blood was collected in a simple vial, left to clot for 30 minutes at room temperature, and then centrifuged for 10 minutes at 3000 revolutions per minute (rpm).

In the Department of Biochemistry at Patna Medical College in Patna, Bihar, the immunoassay approach employing the ELISA technique [14] was used to estimate serum vitamin D levels. 25(OH)D of 20 ng/ml or less is regarded a vitamin D deficiency, while 25(OH)D of 21–29 ng/ml is called a vitamin D insufficiency. A 25(OH)D of equal to or more than 30 ng/ml is considered a sufficient amount of vitamin D. [15] The data was presented as Mean  $\pm$  SD. The independent t-test

was used to compare the differences in the means of the different parameters. The chi square test was used to compare categorical variables. During data analysis, a p value of <0.05 was considered statistically significant.

### Results

There was no discernible difference between the two groups' means for age, eating habits, marital status, socioeconomic standing, etc. ( $p>0.05$ ).

Therefore, it was determined that none of these variables could have an impact on serum vitamin D levels. Vitamin D concentrations were significantly impacted by PCOS. The average serum vitamin D level was  $34.12\pm 7.41$  ng/ml in normal participants, ranging from 13.49 to 56.47 ng/ml, and  $21.91\pm 8.49$  ng/ml in PCOS women, ranging from 6.18 to 38.21 ng/ml. The outcomes are shown in Table 1. The total vitamin D levels of PCOS-affected women were significantly lower ( $p<0.0001$ ) than those of healthy women.

**Table 1: Comparison of mean serum vitamin D levels in healthy women (Control Group) and PCOS women (Case Group)**

Values	Normal healthy Women (n=75)	PCOS patients (n=75)
Mean (ng/ml)	34.12	21.91
Range	13.49-56.47	6.18-38.21
SD	7.41	8.49
SEM	0.61	0.69
DF		298
t-statistic		13.270
Significance		$P<0.0001$ (HS*)

\*HS= Highly significant. Based on their vitamin D levels, Table 2 displays the distribution of healthy women and PCOS patients. The proportion of PCOS patients with vitamin D concentrations below adequate levels was 75.33%, compared to only 32% of healthy women. A p-value of less than 0.05 from the chi square test suggests a strong correlation between low vitamin D levels and PCOS (Table 2).

**Table 2: Distribution of cases and controls on the basis of their vitamin D Level**

Vitamin D status	Healthy Women (n=75)	PCOS patients (n=75)
Insufficiency or Deficiency (Vit. D <30 ng/ml)	24(32%)	56(74.67%)
Sufficiency (Vit. D >30 ng/ml)	51(68%)	19(25.33%)
p-value (chi square test)	$P<0.0001$ (HS*)	

\*HS= Highly significant

### Discussion

A number of PCOS symptoms, such as obesity, insulin resistance, ovulatory dysfunction, and metabolic syndrome, may be impacted by vitamin D. [16] The vitamin D receptor (VDR) is a soluble protein that mediates the biological effects of vitamin D. The presence of VDR in the cytoplasm and nucleus of granulosa cells (GC) in human ovaries suggests that it is in charge of the physiologic processes that 1,25(OH)2D3 in ovarian follicles performs. [17] In human ovarian tissue, 1,25(OH)2D3 stimulates the production of progesterone and estrogen, whereas vitamin D may

also increase aromatase activity, which lowers testosterone production. [10] Aromatase gene expression was lower in PCOS women's follicles than in controls, although LH levels were higher. However, progesterone and estradiol follicular output was lower. 18 PCOS symptoms may emerge from a vitamin D insufficiency due to these effects. A shortage in vitamin D is linked to calcium dysregulation, which contributes to the development of follicular arrest in PCOS women and causes problems with menstruation and fertility. [19] There is evidence to suggest that obesity, insulin resistance, and vitamin D deficiency are related. [16] First, by increasing insulin receptor expression and boosting insulin

responsiveness for glucose transport, vitamin D may have a positive impact on insulin function. [20] Second, in insulin-responsive tissues like skeletal muscle and adipose tissue, vitamin D modulates extracellular and intracellular calcium, which is necessary for insulin-mediated intracellular activities. [20]

Lastly, hypovitaminosis D may cause a greater inflammatory response, which is linked to insulin resistance, because vitamin D modulates the immune system. [21,22]

Obesity is one of the potential causes of the high prevalence of vitamin D deficiency in PCOS-affected women, as vitamin D is stored in adipose tissue and obese women may spend less time in the sun. [9,23]

The current investigation supports all of the previously mentioned theories regarding low vitamin D levels and PCOS. According to our findings, there is a clear correlation between vitamin D deficiency and polycystic ovarian syndrome.

In this study, the vitamin D concentration of PCOS-affected women was significantly lower ( $p < 0.0001$ ) than that of healthy women, with 75.33% of PCOS-affected women having vitamin D levels below the recommended range.

The present study findings were consistent with those of Mazloomi et al. [24] A number of earlier research produced contradictory findings; for example, Mahmoudi et al. 8 showed elevated vitamin D levels in PCOS women, while Li et al. [9] observed no difference in vitamin D levels between PCOS patients and controls.

### Conclusion

The results of the present study regarding hypovitaminosis in PCOS patients suggest that vitamin D insufficiency could be a risk factor or contribute to the pathophysiology of PCOS. Despite the paucity of evidence at this time, more randomized controlled trials are needed to validate the possible advantages of vitamin D supplementation for women with PCOS. Nevertheless, vitamin D supplementation may play a role in the multifaceted care of female PCOS patients.

Additionally, this management may lessen the chance of death and morbidity linked to PCOS's metabolic syndrome.

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