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ORIGINAL ARTICLE

Determine the Frequency of Vitamin D Deficiency in Polycystic Ovarian Syndrome Patients

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ABSTRACT

Background: Vitamin D deficiency can lead to various comorbidities including fertility issues among females. Polycystic ovarian syndrome is a main fertility related issue of females requiring effective treatment protocols.
Objective: To determine the frequency of vitamin D deficiency in polycystic ovarian syndrome patients.
Study Design: Cross-sectional analytical study
Place and Duration of Study: Department of Obstetrics & Gynaecology, Gujranwala Medical College, Gujranwala from 1st April 2023 to 30th September 2023.
Methodology: A total of 100 cases diagnosed through clinical assessment, follicle stimulating hormones and luteinizing hormone ratios (abnormal as 3:1) and confirmed for polycystic ovarian morphology through ultrasound were included in this study. The tests included fasting glucose, homeostatic model assessment of insulin resistance (HOMA-IR), mean 25-hydroxyvitamin D3 [25(OH)D3], serum testosterone, follicle stimulating hormones and luteinizing hormone. The anthropometric measurements including body mass index and waist circumference were taken of each patient through digital weight and height measuring machine while inch in tape measuring waist circumference was also applied. The patients having 25(OH)D3 levels <30 ng/ml (10-29) were categorized as in Group I with vitamin D deficiency while those having >30 ng/ml vitamin D levels were categorized as in Group II with normal vitamin D levels. A comparative analysis of various variables was performed within both groups.
Results: There were 60% of those who were having vitamin D deficiency, while 40% were having normal vitamin D levels presented. The patients were between 16-35 years of age. The body mass index of those females having vitamin D deficiency in Group I were having higher body mass index than normal vitamin D level patients in group II. The fasting glucose levels as well as HOMA-IR of Group I patients was higher than Groups II (92.6±12.4 vs 80.2±9.9 mg/dl and 3.8±1.1 vs 3.4±0.9) respectively. The mean levels of Vitamin D in group I was 12.7±3.3ng/mL in comparison to the mean value of vitamin D as 33.1±7.8ng/ml in Group II. An elevated serum testosterone in Group I was 7.4±2.2vs 5.3±0.9 ng/ml. The FSH:LH ratio was severely affected in Group I who were vitamin D deficient females in comparison to the normal vitamin D Group II patients. There is a negative correlation between the vitamin D levels and body mass index, HOMA-IR, serum hormonal levels including serum follicle stimulating hormones, luteinizing hormone and testosterone levels.
Conclusion: Around 60% of polycystic ovarian syndrome females were having 25(OH) vitamin D_3 deficiency in them.
Keywords: Frequency, Vitamin D deficiency, Polycystic ovarian syndrome

INTRODUCTION

Polycystic ovarian syndrome (PCOS) is a common endocrine disorder affecting women of reproductive age. It is clinically defined by the presence of polycystic ovarian morphology, hyperandrogenism, and ovulatory dysfunction. Although the exact cause of PCOS remains uncertain, current evidence supports a multifactorial etiology, with genetic predisposition playing a significant role.[1,2]

A key feature in the pathophysiology of PCOS is insulin resistance, which is closely linked to weight gain and increased waist circumference. Insulin resistance strongly correlates with hyperandrogenemia and impaired ovarian function. Both obesity and insulin resistance are known to exacerbate hyperandrogenemia. As a result, women with PCOS are at increased risk for several comorbid conditions, including cardiovascular disease, type 2 diabetes mellitus, hypertension, endometrial cancer, and inflammatory disorders, primarily due to increased adiposity and elevated androgen levels.[3-6]

Vitamin D deficiency has also been associated with a heightened risk for numerous chronic conditions, such as obesity, cardiovascular disease, type 2 diabetes, cancer, autoimmune disorders, infectious diseases, and various mental health issues. Obesity is a well-established risk factor for vitamin D deficiency, and previous studies have demonstrated a negative correlation between body mass index (BMI) and serum 25-hydroxyvitamin D [25(OH)D3] levels in women with PCOS.[7-9]

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The connection between PCOS and vitamin D deficiency, some evidence suggests that low vitamin D levels may contribute to the development of PCOS. Additionally, vitamin D levels tend to be lower in obese women with PCOS compared to their non-obese counterparts.[10] The present study was designed to assess the frequency of the vitamin D deficiency in PCOS cases. The study further highlighted the correlation of vitamin D with PCOS patients. The results of this assist in providing evidential data for betterment of women suffering with PCOS.

MATERIALS AND METHODS

This cross-sectional analytical study was conducted at Department of Obstetrics & Gynaecology, Gujranwala Medical College, Gujranwala from 1st May 2023 to 31st October 2023. A total of 100 cases diagnosed through clinical assessment of FSH and LH ratios (abnormal as 3:1) and confirmed for polycystic ovarian syndrome through ultrasound were included in this study. The sample size was generated via sample size calculator applying 80% power of test, 95% confidence of interval and 5% margin of error. Those women who were having amenorrhea, or other fertility related disorders were not included in this study. The patients on vitamin D supplementation were also excluded from the study. A 3cc blood was withdrawn from each patient and a complete biochemical and endocrinal serum/blood analysis was performed using automated biochemical analyzing machine. The tests included Fasting glucose, HOMA-IR, mean 25(OH)D3, serum testosterone, follicle stimulating hormones (FSH), luteinizing hormone (LH). The anthropometric measurements including BMI and waist circumference were taken of each patient through digital weight and height measuring machine while inch in tape measuring waist

circumference was also applied. The patients having 25(OH)D3 levels <30 ng/ml (10-29) were categorized as in Group I with vitamin D deficiency while those having >30 ng/ml vitamin D levels were categorized as in Group II with normal vitamin D levels. A comparative analysis of various variables was performed within both groups. Data was analyzed using SPSS version 26.0 wherein chi square test was applied for analysis using p value <0.001 as significant.

RESULTS

There were 60% having vitamin D deficiencywhile40% were having normal vitamin D levels (Fig. 1). The mean age of the patients was 29.1±5.65 years. The patients were between 16-35 years of age. The BMI of those females having vitamin D deficiency in Group I were having higher BMI than normal vitamin D level patients in group II. The fasting glucose levels as well as HOMA-IR of Group I patients was higher than Groups II (92.6±12.4 vs 80.2±9.9 mg/dl and 3.8±1.1 vs 3.4±0.9) respectively. The mean levels of Vitamin D in group I was 12.7±3.3ng/mL in comparison to the mean value of vitamin D as 33.1±7.8ng/ml in Group II (Table 1).

Table 1: Demographic, clinical and biochemical comparative levels within group I and II patients

Variables	PCOS		P value
	Group I (Deficient) N=50	Group II (Normal) N=50	
Age(years)	28.8±5.1	29.4±6.2	0.923
Body mass index (kg/m^2)	29.2±4.7	25.9±2.3	0.013
Waist circumference (cm)	91.6 ± 12.7	82.1±10.2	0.021
Fasting glucose, mg/dl	92.6±12.4	80.2±9.9	0.026
HOMA-IR	3.8±1.1	3.4±0.9	0.038
Mean 25(OH)D3 (ng/mL)	12.7±3.3	33.1±7.8	0.001

25(OH) Vit D Deficient= 10-12 ng/ml, 25(OH)D3Normal (≥30 ng/ml)

Table 2: Comparison of hormonal levels within Group I and Group II patients

Variables	PCOS		P value
	Group I (Deficient) N=50	Group II (Normal) N=50	
Serum testosterone (ng/ml)	7.5±2.2	5.2±0.9	0.012
FSH (mIU/mL)	6.9±2.4	6.4±1.7	0.773
LH (mIU/mL)	18.4±2.0	9.5±0.8	0.001

Table 3: Correlation of vitamin D levels with endocrine and metabolic variables with PCOS

Parameters	R	P
Age (years)	0.014	0.347
BMI (kg/m2)	−0.460	0.003
Waist circumference (cm)	−0.316	0.024
Fasting glucose (mg/dl)	−0.308	0.032
HOMA-IR	−0.386	0.007
FSH, mIU/mL	−0.135	0.125
LH (mIU/mL)	−0.322	0.028
Serum testosterone (ng/ml)	−0.375	0.013

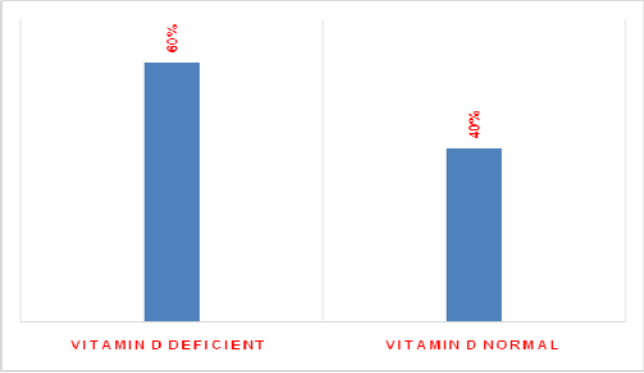

Fig. 1: Frequency of PCOs in women

The hormonal assessment including testosterone, follicle stimulating hormone (FSH), luteinizing hormone (LH) were compared within Group I and Group II. It was observed that an elevated serum testosterone in Group 1 7.5±2.2vs 5.2±0.9 ng/ml in Group II was observed. The FSH:LH ratio was severely affected in Group I who were vitamin D deficient females in comparison to the normal vitamin D Group II patients (Table 2). There is a negative correlation between the vitamin D levels and BMI, HOMA-IR, serum hormonal levels including serum FSH, LH and Testosterone levels (Table 3).

DISCUSSION

Women diagnosed with polycystic ovarian syndrome (PCOS) frequently exhibit insulin resistance, which contributes to elevated levels of inflammatory markers and an increased risk of type 2 diabetes and cardiovascular disease. These conditions have also been associated with vitamin D deficiency. However, the exact nature and underlying mechanisms of this relationship remain unclear. The pathogenesis of PCOS is complex, involving both genetic and environmental factors.[11,12]

The findings of the current study indicate that vitamin D deficiency exacerbates clinical symptoms and negatively impacts the metabolic and hormonal profiles of PCOS patients, consistent with previous research. These results suggest that vitamin D deficiency may play a contributory role in the development or progression of PCOS. A strong association exists between insulin resistance and PCOS, and vitamin D has been implicated in the development of insulin resistance.[13]

Numerous studies have reported a link between PCOS and vitamin D deficiency, although the precise pathophysiological mechanisms remain poorly understood. While the role of vitamin D in the etiology of PCOS is yet to be fully clarified, prior studies have demonstrated a positive correlation between PCOS and factors such as body mass index (BMI), body fat, and insulin resistance. Additionally, disruptions in intracellular calcium homeostasis due to vitamin D deficiency may impair ovulation and reproductive function in women with PCOS.[14-16]

In the present study, individuals with vitamin D deficiency showed significantly higher BMI, fasting glucose, and HOMA-IR values ($p<0.05$), aligning with earlier findings. A negative correlation was observed between vitamin D levels and BMI, insulin resistance, and fasting glucose in PCOS patients. These observations reinforce the hypothesis that vitamin D deficiency is a potential risk factor for PCOS.[17]

Both PCOS and vitamin D deficiency have been recognized as risk factors for atherosclerosis and hypertensive disorders, which contribute to increased morbidity and mortality from cardiovascular disease. Vitamin D supplementation has been shown to lower systolic blood pressure and reduce cardiovascular-related mortality.[18-20]

In the current study, levels of serum testosterone, and luteinizing hormone (LH) were significantly higher in the vitamin D-deficient group ($p<0.05$), supporting the association between vitamin D deficiency and elevated androgen levels in PCOS. These findings suggest that vitamin D levels may serve as indicators of metabolic and hormonal status in PCOS patients. Several studies have demonstrated that vitamin D supplementation can enhance insulin sensitivity and reduce androgen levels in PCOS patients with vitamin D deficiency.[15-17]

CONCLUSION

Around 60% of polycystic ovarian syndrome females were having 25(OH)D3 deficiency. Vitamin D 3 had a negative correlation between the vitamin D levels and body mass index, HOMA-IR, serum hormonal levels including serum follicle stimulating hormones, luteinizing hormone and testosterone levels.

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