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Original Research Article

RELATIONSHIP BETWEEN VITAMIN D LEVEL AND POLYCYSTIC OVARY SYNDROME

Shelja[1], Manisha Moda[2], Pinki[3], Naiya Devgan[4], Amisha Rathee[5], Rajesh Bareja[6]

[1]Associate Professor, Department of Physiology, Pt. BDS PGIMS, Rohtak, Haryana, India.
[2]Associate Professor, Department of Obstetrics and Gynaecology, World College of Medical Sciences and Research, Jhajjar, Haryana, India.
[3]Senior Resident, Department of Obstetrics and Gynaecology, World College of Medical Sciences and Research, Jhajjar, Haryana, India.
[4]Associate Professor, Department of Obstetrics and Gynaecology, World College of Medical Sciences and Research, Jhajjar, Haryana, India.
[5]Intern, SGT Medical College Hospital and Research Institute, SGT University, Gurugram, Haryana, India.
[6]Professor, Department of Microbiology, World College of Medical Sciences and Research, Jhajjar, Haryana, India.

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Corresponding Author:
Dr. Naiya Devgan,
Email: naiyadevgan19@gmail.com

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Abstract

Background: To assess the relationship between vitamin D level and polycystic ovary syndrome. **Materials and Methods:** 70 women of reproductive age 18- 38 years were divided into two groups. Group I with 25(OH)D3 deficiency, and group II with normal 25(OH)D3. Weight, height, body mass index (BMI) and waist circumference (WC) and biochemical measurements were done. **Results:** Age group 18-28 years had 15 males and 17 females and 28-38 years had 20 males and 18 females. The mean age in group I patients was 28.2 years and in group II was 27.5 years. The mean height was 154. Cm and 152 cm in group I and II respectively. The mean weight was 65.1 kgs and 68.2 kgs, BMI was 27.4 kg/m2 and 29.4 kg/m2, waist circumference (WC) was 95.2 cm and 81.5 cm. The mean fasting glucose level was 94.2 mg/dl in group I and 82.4 mg/dl in group II. HOMA- IR was 3.7 in group I and 3.1 in group II. Serum calcium was 8.5 mg/dl in group I and 9.8 mg/dl in group II. Triglyceride was 145.5 mg/dl in group I and 139.4 mg/dl in group II. LDL-C was 147.2 mg/dl in group I and 146.2 mg/dl in group II. HDL-C was 41.1 mg/dl in group I and 50.2 mg/dl in group II. The mean FSH (mlU/mL) was 6.5 and 6.2 in group I and group II respectively. The mean LH (mlU/mL) was 8.6 and 9.4, serum testosterone (ng/ml) was 7.4 and 5.3, PRL (ng/ml) was 23.3 and 15.6, DHEA-S (ng/ml) was 716.4 and 530.4, TSH (µIU/L) was 2.8 and 2.5 and sT4, pmol/L was 11.3 and 12.5 in group I and group II respectively. A significant difference was observed (P< 0.05). There was correlation between 25(OH)D3 levels and WC, BMI, fasting glucose, HOMA- IR, LH, serum testosterone and DHEA-S (P< 0.05). **Conclusion:** Vitamin D deficiency exacerbates the risk of polycystic ovary syndrome. There was correlation between polycystic ovary syndrome and vitamin D deficiency.

INTRODUCTION

Polycystic ovary syndrome (PCOS) is a common cause of ovarian dysfunction in women with anovulation.[1] The main symptoms are characterized by chronic anovulation, hyperandrogenism, and/or the presence of polycystic ovary morphology from ultrasound examination. The phenotypic manifestation of this disorder is associated with various degrees of gonadotropic and metabolic abnormalities determined by the interaction of multiple genetic and environmental factors.[2]

Vitamin D plays a physiologic role in reproduction including ovarian follicular development and luteinization via altering anti-müllerian hormone (AMH) signalling, follicle-stimulating hormone sensitivity and progesterone production in human granulosa cells. It also affects glucose homeostasis through manifold roles.[3]

Vitamin D is a steroid hormone that is endogenously synthesized through skin exposure to solar ultraviolet light; however, <10–20% is derived from diet.[4] The active form 1,25-dihydroxyvitamin D acts on its respective receptor, which is present at

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multiple locations throughout the body (intestine, breast, bones, pancreas, kidney, and immune cells), to modulate the organ metabolism and function. In addition, vitamin D upregulates insulin synthesis and secretion by pancreatic cells.5 In women affected by PCOS, a suboptimal vitamin D level (<20 ng/mL) was found to be linked with several risk factors associated with PCOS, including hyperglycemia; increased scores on the homeostatic model assessment for insulin resistance (HOMA-IR); increases in levels of total cholesterol, low-density lipoprotein cholesterol (LDL-C), triglyceride (TG), and fasting plasma glucose levels; and a decrease in high-density lipoprotein cholesterol (HDL-C) level.[6] The present study assessed the relationship between vitamin D level and polycystic ovary syndrome.

MATERIALS AND METHODS

A sum total of seventy women of reproductive age 18- 38 years were selected after obtaining approval from ethical review committee. Patients' consent was obtained before starting the study.

Demographic data such as name, age etc. was recorded. Patients were divided into two groups. Group I with 25(OH)D3 deficiency, and group II with normal 25(OH)D3. Weight, height, and waist circumference (WC) measurements were recorded. Body mass index (BMI) was calculated by dividing weight (in kilograms) by height (in meters) squared. WC measurements were performed at the level of the iliac processes and umbilicus. Biochemical and hormonal parameters (androgen hormones, gonadotropins, and thyroid function tests) was assessed. The results were compiled and subjected for statistical analysis using chi- square test. P value less than 0.05 was considered significant.

RESULTS

Table 1: Patients distribution based on age group

Age group (years)	Group I (35)	Group II (35)
18-28	15	17
28-38	20	18
Mean age	28.2	27.5

Age group 18-28 years had 15 males and 17 females and 28-38 years had 20 males and 18 females. The mean age in group I patients was 28.2 years and in group II was 27.5 years [Table 1].

Table 2: Comparison of parameters

Parameters	Group I	Group II	P value
Height (cm)	154	152	0.84
Weight (kg)	65.1	68.2	0.62
BMI (kg/m2)	27.4	29.4	0.05
WC (cm)	95.2	81.5	0.04
Fasting glucose (mg/dl)	94.2	82.4	0.05
HOMA- IR	3.7	3.1	0.05
Serum calcium (mg/dl)	8.5	9.8	0.02
Triglyceride (mg/dl)	145.5	139.4	0.57
LDL-C (mg/dl)	147.2	146.2	0.92
HDL-C (mg/dl)	41.1	50.2	0.03
FSH (mlU/mL)	6.5	6.2	0.46
LH (mlU/mL)	8.6	9.4	0.01
Serum testosterone (ng/ml)	7.4	5.3	0.92
PRL (ng/ml)	23.3	15.6	0.82
DHEA-S (ng/ml)	716.4	530.4	0.01
TSH (µIU/L)	2.8	2.5	0.88
sT4, pmol/L	11.3	12.5	0.02

The mean height was 154. Cm and 152 cm in group I and II respectively. The mean weight was 65.1 kgs and 68.2 kgs, BMI was 27.4 kg/m2 and 29.4 kg/m2, waist circumference (WC) was 95.2 cm and 81.5 cm. The mean fasting glucose level was 94.2 mg/dl in group I and 82.4 mg/dl in group II. HOMA- IR was 3.7 in group I and 3.1 in group II. Serum calcium was 8.5 mg/dl in group I and 9.8 mg/dl in group II. Triglyceride was 145.5 mg/dl in group I and 139.4 mg/dl in group II. LDL-C was 147.2 mg/dl in group I and 146.2 mg/dl in group II. HDL-C was 41.1 mg/dl in group I and 50.2 mg/dl in group II. The mean FSH (mlU/mL) was 6.5 and 6.2 in group I and group II respectively. The mean LH (mlU/mL) was 8.6 and 9.4, serum testosterone (ng/ml) was 7.4 and 5.3, PRL (ng/ml) was 23.3 and 15.6, DHEA-S (ng/ml) was 716.4 and 530.4, TSH (µIU/L) was 2.8 and 2.5 and sT4, pmol/L was 11.3 and 12.5 in group I and group II respectively. A significant difference was observed (P< 0.05) [Table 2].

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Table 3: Correlation of 25(OH)D3 levels and various parameters

Parameters	R value	P value
Age (years, mean)	0.016	0.73
WC (cm)	-0.324	0.01
BMI (kg/m2)	-0.432	0.04
Serum testosterone (ng/ml)	-0.353	0.02
DHEA-S (ng/ml)	-0.410	0.03
TSH (µIU/L)	0.021	0.61
sT4, pmol/L	0.019	0.56
Fasting glucose (mg/dl)	-0.390	0.02
HOMA- IR	-0.384	0.04
FSH (mlU/mL)	-0.182	0.19
LH (mlU/mL)	-0.382	0.03

There was correlation between 25(OH)D3 levels and WC, BMI, fasting glucose, HOMA- IR, LH, serum testosterone and DHEA-S (P< 0.05) [Table 3].

DISCUSSION

Polycystic ovary syndrome (PCOS) is an endocrine disease frequently seen in women of reproductive age. PCOS is characterized by polycystic ovarian morphology, hyperandrogenism, and ovulatory impairment.[7] The etiology of PCOS is still unclear. However, evidence suggests a multi-factorial origin, with expression being seen in women with a genetic disposition.[8] The basic finding in the pathophysiology of PCOS is insulin resistance.[2] This develops in association with weight gain and an increase in waist circumference and is powerfully associated with hyperandrogenemia and ovarian dysfunction.[9] Obesity and insulin resistance aggravate hyperandrogenemia. The incidence of cardiovascular diseases, type 2 diabetes mellitus, hypertension, endometrial cancer, and inflammation-related conditions increases in association with increased adipose tissue and hyperandrogenemia in women with PCOS.[10] A growing body of evidence has linked higher prevalence of PCOS to vitamin D deficiency. The potential influences of vitamin D on glucose homeostasis include the presence of specific vitamin D receptor (VDR) in pancreatic β-cells and skeletal muscle, the expression of 1-α-hydroxylase enzyme which can catalyze the conversion of 25-hydroxy vitamin D [25(OH)D] to 1,25-dihydroxyvitamin D, and the presence of a vitamin D response element in the human insulin gene promoter.[11,12] The present study assessed the relationship between vitamin D level and polycystic ovary syndrome.

Our results showed that age group 18-28 years had 15 males and 17 females and 28-38 years had 20 males and 18 females. The mean age in group I patients was 28.2 years and in group II was 27.5 years. Bindayel et al.[13] in their study 31 women with PCOS and 75 controls were enrolled. The patients with PCOS had lower vitamin D levels, a significantly higher rate of obesity and significantly higher serum triglyceride levels than did controls. The number of patients with PCOS consumed milk and dairy products and exposed to sun were lower compared to controls. Triglyceride levels were significantly correlated with body mass index (BMI); vitamin D level was not significantly correlated with anthropometrical or biochemical variables. These results affirm that vitamin D levels are lower in women with PCOS; however, despite the significantly higher proportion of obesity among patients with PCOS, hypovitaminosis was not associated with BMI.

Our results showed that the mean height was 154 cm and 152 cm in group I and II respectively. The mean weight was 65.1 kgs and 68.2 kgs, BMI was 27.4 kg/m2 and 29.4 kg/m2, waist circumference (WC) was 95.2 cm and 81.5 cm. The mean fasting glucose level was 94.2 mg/dl in group I and 82.4 mg/dl in group II. HOMA- IR was 3.7 in group I and 3.1 in group II. Serum calcium was 8.5 mg/dl in group I and 9.8 mg/dl in group II. Triglyceride was 145.5 mg/dl in group I and 139.4 mg/dl in group II. LDL-C was 147.2 mg/dl in group I and 146.2 mg/dl in group II. HDL-C was 41.1 mg/dl in group I and 50.2 mg/dl in group II. The mean FSH (mlU/mL) was 6.5 and 6.2 in group I and group II respectively. The mean LH (mlU/mL) was 8.6 and 9.4, serum testosterone (ng/ml) was 7.4 and 5.3, PRL (ng/ml) was 23.3 and 15.6, DHEA-S (ng/ml) was 716.4 and 530.4, TSH (µIU/L) was 2.8 and 2.5 and sT4, pmol/L was 11.3 and 12.5 in group I and group II respectively. Gokosmanoglu et al14 enrolled 267 patients with PCOS which were divided into two groups. Group 1 with 25(OH)D3 deficiency, and group 2 with normal 25(OH)D3. Results showed that 86% of the patients (n=231) were in group 1 and 14% (n=36) in group 2. Statistically significantly higher concentrations of serum testosterone, dehydroepiandrosterone- sulfate and LH were determined in Group 1 ($p<0.05$). 25(OH)D3 concentrations were negatively correlated with body mass index ($r=-0.459$), serum testosterone ($r=-0.374$) and dehydroepiandrosterone- sulfate levels ($r=-0.418$); (all; $p< 0.05$).

Our results showed that there was correlation between 25(OH)D3 levels and WC, BMI, fasting glucose, HOMA- IR, LH, serum testosterone and DHEA-S. Moini et al.[15] compared serum level of 25hydroxyvitamin D [25(OH)D] between PCOS patients and normal individuals. Among PCOS

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patients, results shows 3 (2.4%) normal, 7(5.6%) with insufficiency, 33 (26.4%) with deficiency and 82 (65.6%) with severe deficiency, whereas in normal participants, 5 (4.3%) normal, 4 (3.4%) with insufficiency, 28 (23.9%) with deficiency and 80 (68.4%) with severe deficiency. Comparison of 25(OH)D level between two main groups showed no significant differences. Also, the calcium and 25 (OH)D levels had no significant differences in patients with overweight and insulin resistance. But we also found a relationship between 25 (OH)D level and metabolic syndrome. Furthermore, there was a correlation between 25(OH)D and body mass index (BMI) in control group while the C-reactive protein (CRP) level was predominantly higher in PCOS group.

CONCLUSION

Authors revealed that vitamin D deficiency exacerbates the risk of polycystic ovary syndrome. There was correlation between polycystic ovary syndrome and vitamin D deficiency.

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