



Polycystic Ovarian Syndrome and Its Association with Vitamin D

Parth Shah*

3452 Lake Lynda Dr, Building 100, Suite 151, Orlando, FL, USA

Keywords

Vitamin D; Polycystic Ovarian Syndrome; PCOS; Diabetes; Pregnancy; Ovulation

Introduction

The polycystic ovarian syndrome (PCOS) is generally characterized by hyperandrogenism, irregular menses, and polycystic ovaries. The clinical presentation of the PCOS may include acne, hirsutism, acanthosis nigricans, weight gain, and insulin resistance. The prevalence of PCOS, although varied by diagnostic criteria, is estimated to be as high as 15% to 20% [1]. In the United States, PCOS is the most common cause of an ovulatory infertility (90% to 95%) and infertility affects about 40% of PCOS women [1-3]. There is an increased risk of gestational diabetes mellitus (GDM) and type II diabetes mellitus (DMII) in women with PCOS. In a large Danish study, the total event rate of DMII was 4 times higher in the PCOS group compared to the controls and diagnosis of DMII occurred at a median age of 31 in the PCOS group versus 35 years in the control group [4]. Considering the prevalence of PCOS and its long-term implications, it has become important to explore recent therapeutic findings involving the association between PCOS and vitamin D.

PCOS and Vitamin D

Vitamin D may serve as a key in preventing and attenuating the insulin resistance. In one study, PCOS women (not on insulin sensitizers and hormone therapy) were divided into two groups based on their vitamin D status: vitamin D <30 ng/mL or normal vitamin D [5]. It was found that the body mass index (BMI), body fat, and testosterone were higher in the vitamin D <30 ng/mL cohort compared to the normal vitamin D cohort [5]. In a Saudi women study, the age and BMI matched PCOS and non-PCOS women were assessed for fasting serum levels of vitamin D, hyperinsulinemic factors, and hormones of interest [6]. It was found that the vitamin D levels were lower (<30 ng/mL) in the PCOS group than the control group, 77.8% vs. 12.3%, respectively [6]. Furthermore, there was a positive correlation between vitamin D levels with adiponectin and FSH levels, and an inverse relationship between the vitamin D levels and follistatin, HOMA-IR, fasting plasma glucose (FPG), LH, testosterone, and androstenedione [6].

Number of interventional studies with vitamin D has shown promising results. Kardag et al. [7] started PCOS and non-PCOS women with vitamin D deficiency (<20 ng/mL) on vitamin D 1500 IU/day for 4-weeks and 50,000 IU/week for 8 weeks. In the PCOS group, the insulin sensitivity increased, and serum androstenedione and total testosterone decreased; in contrast, these values didn't change significantly in the non-PCOS group [7]. This may imply that vitamin D may be beneficial in promoting insulin sensitivity only in PCOS women; however, multiple studies on non-PCOS women with GDM have found improvements in insulin sensitivity with vitamin D supplementation [8-12].

In another study, 180 women with PCOS and vitamin D levels <30 ng/mL were randomized to receive either the vitamin D 20,000 IU/week or placebo for 24 weeks [13]. It was found that the vitamin D supplementation led to a decrease in plasma glucose after one-hour oral glucose tolerance test (OGTT) of mean -10 mg/dL compared to the placebo [13]. Seyyed et al. [14] found that women with PCOS who were given Vitamin D 50,000 IU/week versus placebo had significant change in FPG of -7.67 mg/dL versus -1.71 mg/dL, and improvements in the homeostatic model of assessment-estimated B cell function (HOMA-B) and adiponectin. Another study illustrated that the PCOS women who were given vitamin D 4,000 IU, 1,000 IU, or placebo daily for 12 weeks had significantly reduced total testosterone (TT), free androgen index (FAI), and increased sex-hormone binding globulin (SHBG) on high-dose of vitamin D supplementation compared to the low-dose or placebo group [15]. In a similar study, PCOS women were randomized to either the

OPEN ACCESS

*Correspondence:

Parth Shah, 3452 Lake Lynda Dr,
Building 100, Suite 151, Orlando, FL
32817, Tel: +513-571-5377;
E-mail: prshah06@gmail.com

Received Date: 18 Aug 2018

Accepted Date: 11 Sep 2018

Published Date: 13 Sep 2018

Citation:

Shah P. Polycystic Ovarian Syndrome
and Its Association with Vitamin D. *Ann
Med Medical Res.* 2018; 1: 1008.

Copyright © 2018 Parth Shah. This is
an open access article distributed under
the Creative Commons Attribution
License, which permits unrestricted
use, distribution, and reproduction in
any medium, provided the original work
is properly cited.

vitamin D 4,000 IU/day, 1,000 IU/day, or placebo group for 12 weeks of intervention [16]. This study also found that within the vitamin D 4,000 IU/day group, there were significant decreases in the fasting plasma glucose, serum insulin concentrations, and homeostatic model of insulin resistance (HOMA-IR) [16]. In a double-blind placebo-controlled study, PCOS women were started on vitamin D 60,000 IU weekly or placebo for 12 weeks [17]. In the vitamin D group, there was a significant improvement in insulin resistance and sensitivity [17]. Overall, multiple studies indicate a significant improvement in insulin resistance and androgenic factors in PCOS women supplemented with high dose vitamin D.

Fertility in PCOS Women and Vitamin D

Some clinical studies have demonstrated an improvement in fertility status in PCOS women who have better vitamin D status. A cross-sectional study in 1,102 African American women illustrated that doubling of vitamin D levels from median of 14.7 ng/mL to 29.4 ng/mL was associated with half the odds of having long menstrual cycles [18]. A retrospective study assessed vitamin D status in PCOS women and their reproductive outcomes after ovulation induction. It was found that the live birth rate was 40% reduced in women with vitamin D <30 ng/mL; furthermore, improvements in live birth success were noted at thresholds ≥ 38 ng/mL (OR 1.42) and ≥ 45 ng/mL (OR 4.46) [19]. Consequently, the study points out that the vitamin D status was an independent predictor of ovulation and live birth post induction [19]. In a randomized placebo-controlled trial, PCOS women with fertility issues undergoing intrauterine insemination (IUI) were treated with either vitamin D or placebo [20]. The women in vitamin D group had significant improvements in their endometrial thickness [20].

A study assessing impact of vitamin D on the success of ovarian stimulation in women with PCOS or unexplained infertility found that in the PCOS women group, those with vitamin D deficiency (<20 ng/mL) had lower chance of ovulation and a 40% decrease in the rate of live birth [21]. Wong et al. [22] found that in women with PCOS, serum anti-mullerian hormone levels were positively and independently correlated with the vitamin D levels. In the obese PCOS women started on weight loss intervention plus 50,000 IU/week vitamin D or weight loss intervention plus placebo for 12 weeks, there were no significant differences found between the groups in fat mass, waist and hip circumference, DHEAS, total testosterone, weight, BMI, fat mass, waist and hip circumference, waist-to-hip ratio, DHEA-S, TT, FAI, and SHBG [23]. However, there was a significant improvement in menstrual frequency in women on vitamin D [23].

Conclusion

Multiple studies have illustrated an inverse association between the vitamin D status, and hyperandrogenism and insulin resistance. Consequently, intervention with vitamin D at doses as high as 50,000 to 60,000 IU/week have provided improvements in the hyperinsulinemia, and androgenic and fertility factors in PCOS women. Overall, high dose vitamin D supplementation has shown promising results in improving the treatment of the PCOS patients.

References

1. Sirmans SM, Pate KA. Epidemiology, diagnosis, and management of polycystic ovary syndrome. *Clin Epidemiol*. 2013;6:1-13.
2. Carrie C, Dennett, Judy Simon. The role of polycystic ovary syndrome in reproductive and metabolic health: overview and approaches for treatment. *Diabetes Spectr*. 2015;28(2):116-20.
3. Teede H, Deeks A, Moran L. Polycystic ovary syndrome: a complex condition with psychological, reproductive and metabolic manifestations that impacts on health across the lifespan. *BMC Med*. 2010;8:41.
4. Rubin KH, Glintborg D, Nybo M, Abrahamsen B, Andersen M. Development and Risk Factors of Type 2 Diabetes in a Nationwide Population of Women With Polycystic Ovary Syndrome. *J Clin Endocrinol Metab*. 2017;102(10):3848-57.
5. Arun Kumar, Satish Barki, Vinod Raghav, Ashutosh Chaturvedi, KVS Hari Kumar. Correlation of Vitamin D with metabolic parameters in polycystic ovarian syndrome. *J Family Med Prim Care*. 2017;6(1):115-9.
6. Kensara OA. Prevalence of hypovitaminosis D, and its association with hypoadiponectinemia and hyperfollistatinemia, in Saudi women with naive polycystic ovary syndrome. *J Clin Transl Endocrinol*. 2018;12:20-5.
7. Karadag C, Yoldemir T, Yavuz DG. Effects of vitamin D supplementation on insulin sensitivity and androgen levels in vitamin-D-deficient polycystic ovary syndrome patients. *J Obstet Gynaecol Res*. 2018;44(2):270-7.
8. Bao W, Song Y, Bertrand KA, Tobias DK, Olsen SF, ChavarroJE, et al. Prepregnancy habitual intake of vitamin D from diet and supplements in relation to risk of gestational diabetes mellitus: A prospective cohort study. *J Diabetes*. 2018;10(5):373-9.
9. Mahdih Mojibian, Sedigheh Soheilykhal, Mohammad Ali Fallah Zadeh, Maryam Jannati Moghadam. The effects of vitamin D supplementation on maternal and neonatal outcome: A randomized clinical trial. *Iran J Reprod Med*. 2015;13(11):687-96.
10. Shahgheibi S, Farhadifar F, Pouya B. The effect of vitamin D supplementation on gestational diabetes in high-risk women: Results from a randomized placebo-controlled trial. *J Res Med Sci*. 2016;21:2.
11. Yazdchi R, Gargari BP, Asghari-Jafarabadi, Sahhaf F. Effects of vitamin D supplementation on metabolic indices and hs-CRP levels in gestational diabetes mellitus patients: a randomized, double-blinded, placebo-controlled clinical trial. *Nutr Res Pract*, 2016;10(3):328-35.
12. Zhang Q, Cheng Y, He M, Li T, Ma Z, Cheng H. Effect of various doses of vitamin D supplementation on pregnant women with gestational diabetes mellitus: A randomized controlled trial. *Exp Ther Med*. 2016;12(3):1889-95.
13. Trummer C, Schwetz V, Kollmann M, Wolfler M, Munzker J, Pieber TR, et al. Effects of vitamin D supplementation on metabolic and endocrine parameters in PCOS: a randomized-controlled trial. *Eur J Nutr*. 2018.
14. Seyyed Abootorabi M, Ayremlou P, Behrooz-Lak T, Nourisaidlou S. The effect of vitamin D supplementation on insulin resistance, visceral fat and adiponectin in vitamin D deficient women with polycystic ovary syndrome: a randomized placebo-controlled trial. *Gynecol Endocrinol*. 2018;34(6):489-94.
15. Jamilian M, Foroozanfar F, Talebi M, Samimi M, Mehrabi S, Badehnoosh B, et al. Effect of Two Different Doses of Vitamin D Supplementation on Metabolic Profiles of Insulin-Resistant Patients with Polycystic Ovary Syndrome. *Nutrients*. 2017;9(8):612-7.
16. Foroozanfar F, Talebi M, Samimi M, Mehrabi S, Badehnoosh B, Jamilian M, et al. Effect of Two Different Doses of Vitamin D Supplementation on Metabolic Profiles of Insulin-Resistant Patients with Polycystic Ovary Syndrome: A Randomized, Double-Blind, Placebo-Controlled Trial. *Horm Metab Res*. 2017;49(8):612-7.
17. Gupta T, Rawat M, Gupta N, Arora S. Study of Effect of Vitamin D Supplementation on the Clinical, Hormonal and Metabolic Profile of the PCOS Women. *J Obstet Gynaecol India*. 2017;67(5):349-55.
18. Jukic AMZ, Upson K, Harmon QE, Baird DD. Increasing serum 25-hydroxyvitamin D is associated with reduced odds of long menstrual cycles in a cross-sectional study of African American women. *Fertil Steril*. 2016;106(1):172-9.
19. Pal L, Zhang H, Williams J, Santoro NF, Diamond MP, Schlaff WD,

- et al. Vitamin D Status Relates to Reproductive Outcome in Women With Polycystic Ovary Syndrome: Secondary Analysis of a Multicenter Randomized Controlled Trial. *J Clin Endocrinol Metab.* 2016;101(8):3027-35.
20. Asadi M, Matin N, Frootan M, Mohamadpour J, Qorbani M, Tanha FD. Vitamin D improves endometrial thickness in PCOS women who need intrauterine insemination: a randomized double-blind placebo-controlled trial. *Arch Gynecol Obstet.* 2014;289(4):865-70.
21. Butts SF, Seifer DB, Koelper N, Senapati S, Sammel MD, Hoofnagle AN, et al. Vitamin D Deficiency is Associated with Poor Ovarian Stimulation Outcome in PCOS but not Unexplained Infertility. *J Clin Endocrinol Metab.* 2018.
22. Wong HYQ, Li HWR, Lam KSL, Tam S, Shek CC, Lee CYV, et al. Independent association of serum vitamin D with anti-Mullerian hormone levels in women with polycystic ovary syndrome. *Clin Endocrinol (Oxf).* 2018.
23. Jafari-Sfidvajani S, Ahangari R, Hozoori M, Mozaffari-Khosravi H, Fallahzadeh H, Nadjarzadeh A. The effect of vitamin D supplementation in combination with low-calorie diet on anthropometric indices and androgen hormones in women with polycystic ovary syndrome: a double-blind, randomized, placebo-controlled trial. *J Endocrinol Invest.* 2018;41(5):597-607.