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ORIGINAL ARTICLE

Prevalence of Vitamin-D Deficiency and its Associations with Skin Color In First Trimester Pregnant Women

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ABSTRACT

Background: Background and Aim: Vitamin D deficiency during pregnancy has negative clinical consequences, such as associations with glucose intolerance, pre-eclampsia, preterm birth and intra-uterine growth retardation. The rate of vitamin D deficiency in first trimester pregnant women differed depending on their skin colour.

Objective: The present study aimed to determine the prevalence of vitamin-D deficiency and its association with skin color in first trimester pregnant women, at a tertiary care hospital in Karachi.

Methodology: This descriptive cross-sectional study was carried out on 156 vitamin-D deficient first trimester pregnant women at Derma Clinic, Fatimiyah Hospital, Karachi from during the period from July 2021 to March 2022. Ethical approval was taken from the hospital's ethical committee. All the twin pregnancy women >18 years with parathyroid history, chronic malabsorption, HIV, liver disease, and suspected drug use were excluded. Vitamin-D deficiency was referred to as <20 ng/mL against sufficient >20 ng/mL. Written informed consent was taken from each individual. During routine examination of pregnancy, approximately 10 mL blood sample was collected and centrifuged. Serum was extracted and analyzed for vitamin-D deficiency. SPSS version 25 was utilized for data analysis.

Results: The overall mean age in vitamin D sufficiency and deficiency was 30.45 and 28.91 years respectively. The incidence of vitamin D deficiency was 53.8% (n=84). Of the total, about 72 (46.2%) pregnant women were vitamin D sufficient. The mean serum concentration (25- hydroxyvitamin D) was 25.9 ng/mL (95% CI, 24.5-27.5) in vitamin-D sufficient group and 10.7 ng/mL (95% CI, 9.5-11.5) in vitamin-D deficient group women. Deficiency in Vitamin-D was significantly found in dark-skinned women compared to light-skinned women (OR 2.56; 95% CI 1.1-6.35) based on the most parsimonious model when adjusted for vitamin D supplement, age, smoking, BMI, and parity.

Conclusion: The present study found that the prevalence of vitamin D deficiency in pregnant women was 53.5%. The differences in prevalence and 25-OH vitamin D levels mainly rely on maternal skin color, highlighting the need for supplementation programs and consequent screening for pregnant women particularly, dark-skinned pregnant women.

Keywords: Vitamin D deficiency, Skin Color, First Trimester, Pregnant women

INTRODUCTION

Vitamin-D deficiency (VDD) is a major public health issue worldwide especially identified as a risk factor for pregnant women. The incidence of vitamin-D deficiency varies from 20% to 40% [1]. The amount of calcium and vitamin-D required during pregnancy are higher than the normally recommended dose [2]. Numerous studies found a significant association between adverse maternal outcomes such as diabetes, low birth weight, and pre-eclampsia and vitamin D deficiency [3-5]. The vitamin D protection program during the last few decades mitigated the vitamin D deficiency associated with health risk factors around the globe. The reemerging of vitamin D deficiency (<20 ng/mL) and suboptimal vitamin D blood levels are prevalent in dark skin color women [[6, 7]. Vitamin D suboptimal level is considerably correlated with various diseases like diabetes, depression, and several types of cancer [8, 9]. Sunlight (UVB) synthesized the vitamin D3 in skin from 7-dehydrocholesterol and transformed it into active 25-hydroxyvitamin D ((25(OH) D) in the liver. A 25 (OH) D is considered to be the best indicator of vitamin D status. A higher risk of vitamin D deficiency might be seen in countries where people are less exposed to sunlight [10].

The VDD level during pregnancy has been related to various clinical consequences that might start from adverse stimulus on glucose tolerance to associated preeclampsia [11]. In specific ethnic groups, birth weight can be improved by vitamin D supplementation. There is scarcity of data regarding the vitamin D supplementation during pregnancy in Pakistani context. Therefore, to our knowledge this is the first study of its kind to determine the prevalence of Vitamin D deficiency and its associations with skin color among pregnant women, at a tertiary care hospital in Karachi, Pakistan.

METHODOLOGY

This descriptive cross-sectional study was carried out on 156 vitamin-D deficient first trimester pregnant women at Derma Clinic, Fatimiyah Hospital, Karachi from July 2021 to March 2022. Ethical approval was taken from the hospital ethical committee. All the twin pregnancy women >18 years with parathyroid history, chronic malabsorption, HIV, liver disease, and suspected drug use were excluded. Vitamin-D deficiency was referred to as <20 ng/mL against sufficient >20 ng/mL. Written informed consent was taken from each individual. During routine examination of pregnancy, approximately 10 mL blood sample was collected and centrifuged. Serum was extracted and analyzed for vitamin-D deficiency.

After blood sampling, on the same day, total 25-hydroxyvitamin D was measured using the vitamin D total-analysis Roche Cobas electrochemiluminescence immunoassay. The detection range for 25(OH) vitamin D is 3.0-70.0 ng/mL, with a variation coefficient of 2.2%-6.8%. A questionnaire was filled by each participant and physician. Women's skin color was assessed based on sun exposure impact on skin reaction, skin phototypes were differentiated using allowable scale. SPSS version 25 was used for data analysis. The variation in skin color was depicted by taking geometric mean and 95% CI for each dark and light-skinned individual. Logistic regression analysis was performed to determine the association between vitamin D deficiency and skin color. Four parsimonious models included i) adjusted for age, ii) age and season, iii) age, season, and BMI, and iv) age, season, BMI, vitamin D supplement, smoking status. Differences between groups were examined using Anova and t-test ($p < 0.05$).

RESULTS

The overall mean age in vitamin D sufficiency and deficiency was 30.45 and 28.91 years respectively. The prevalence of vitamin D

deficiency was 53.8% (n=84). Of the total, about 72 (46.2%) pregnant women were vitamin D sufficient. The mean serum concentration (25- hydroxyvitamin D) was 25.9 ng/mL (95% CI, 24.5-27.5) in vitamin-D sufficient group and 10.7 ng/mL (95% CI, 9.5-11.5) in vitamin-D deficient group women. Deficiency in Vitamin-D was significantly found in dark skin color women compared to light skin color (OR 2.56; 95% CI 1.1-6.35) based on the most parsimonious model when adjusted for vitamin D supplement, age, smoking, BMI, and parity. The prevalence of sun protection in terms of used, never used, and always used in vitamin D sufficient pregnant women was 35 (48.6%), 9 (12.5%), and 28 (38.9%) respectively. In vitamin-D deficient pregnant women, the prevalence of never, sometimes, and always was 26 (31%), 32 (38.0%), and 26 (31%) respectively. Baseline characteristics of all the patients are shown in Table-I. The prevalence of vitamin D deficiency and sufficiency is shown in Figure-1. The prevalence of sun protection in vitamin D deficient and sufficient groups is shown in Figure-2 and 3 respectively. Table-II represents the association of skin color and vitamin D deficiency adjusted for various parameters. Figure-4 illustrate the vitamin D level in terms of ng/mL in deficiency group.

Table-1: Baseline characteristics of all the pregnant women

Parameters	Vitamin D deficient pregnant women n=84	Vitamin D sufficient women n=72	P-value
Age (mean) yrs	28.91	30.45	<0.05
BMI (kg/m2)	23.2 (20.5-26.3)	21.7 (19.9-24.2)	<0.05
25 (OH)D GM 95% CI	10.7 ng/mL (95% CI, 9.5-11.5)	25.9 ng/mL (95% CI, 24.5-27.5)	<0.001
Pregnancy duration (wks)	9 (8-10)	9 (8-10)	0.41
Parity	21	19	0.29
Gravidity	16	15	0.10

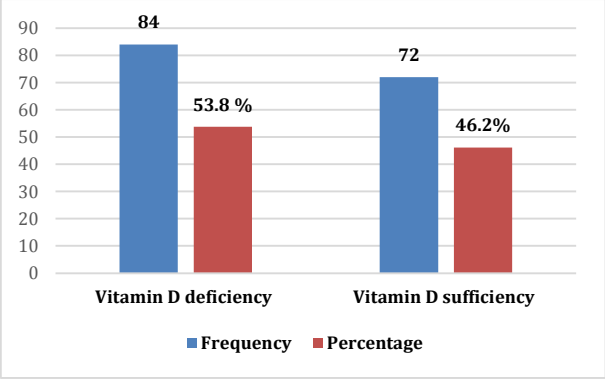

Figure-1: Prevalence of vitamin D deficiency and sufficiency in first trimester pregnant women.

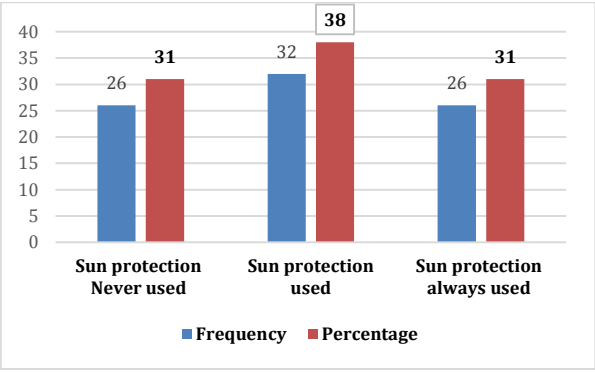

Figure-2 Prevalence of sun protection in vitamin D deficient group (n=84)

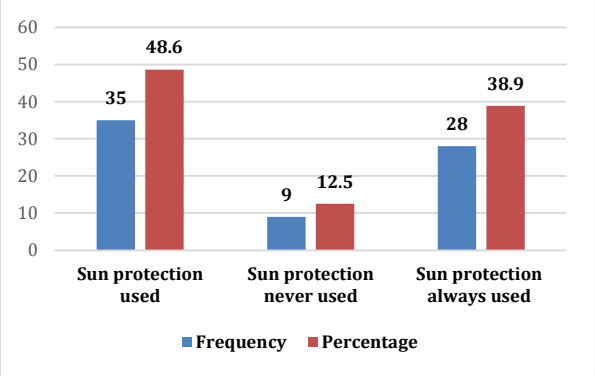

Figure-3: Prevalence of sun protection in vitamin D sufficient group (n=72)

Table-2: Association between skin color and vitamin D deficiency adjusted for various parameters

Dark Skin Color (adjusted)	OR	95% CI
Age	3.31	1.5-7.3
Age + Season	3.35	1.5-7.4
Multivariable	2.61	1.1-6.1

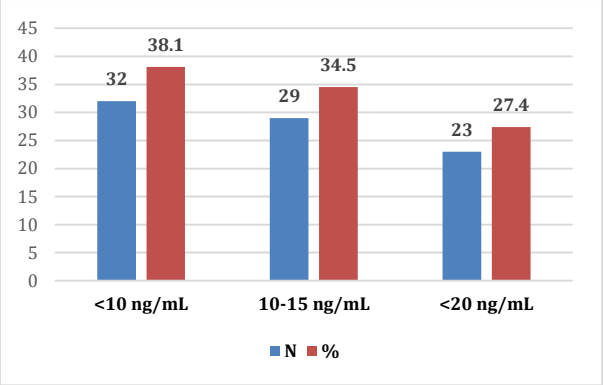

Figure-4: Vitamin D levels in terms of ng/mL in Vitamin D deficient group

DISCUSSION

To our knowledge, the prevalence of vitamin D deficiency in women in the first trimester of pregnancy has not yet been evaluated in Pakistani context.The present study investigated the prevalence of vitamin D deficiency and its association with skin color during first trimester of pregnancy. It has been reported that prevalence of vitamin D deficiency was high i.e; 53.8% in first trimester pregnant women. Additionally, the dark-skinned pregnant women had higher vitamin D deficiency compared to light-skinned pregnant women. Based on WHO criteria, about one to two gram of calcium could be recommended for pregnant women but no routine supplementation of vitamin D was observed during pregnancy [12, 13]. In the present study, about 84 pregnant women had vitamin D deficiency during the first trimester of pregnancy. Vitamin D deficiency was subdivided into three stages: mild, moderate and severe deficiency. The prevalence of mild, moderate, and severe vitamin D deficiency was observed to be 23 (27.4%), 29 (34.5%), and 32 (38.1%) respectively. However, about 72 pregnant women had vitamin D sufficiency.

In Pakistan, very scarce literature has been available on vitamin D deficiency in first trimester pregnant women. A previous study reported that vitamin D deficiency in pregnant women had a frequency of VDD (<20 ng/mL) ranging from 22.7% to 90.3% [14]. However, various studies and systematic reviews reported the prevalence of VDD in first trimester pregnancy ranging from 22.7% to 59% [15-17]. US and Sweden based studies found a heterogeneous prevalence rate of VDD that varies from 10% in early pregnancy in the US to 65% in pregnant women [18]. The

VDD in first trimester pregnant women of Belgium had a prevalence of 47% [19] and 8% to 62% in Netherlands [20]. Another study reported 77.4% prevalence of VDD in first trimester pregnant women [21]. The prevalence of VDD in the present study lies within the range of VDD reported in various studies.

The present study findings regarding skin color resemble the previous studies results according to which skin color is significantly associated with VDD. The variations in vitamin D deficiency might be caused by light and dark skin color differences [22, 23]. Additionally, various studies reported that the dark-skinned population especially in the US and Europe had lower levels of vitamin D in ethnic groups. Individuals who are dark-skinned produce lesser 25 (OH) D upon exposure to sun light than individuals who are light-skinned [24, 25].

Vitamin D has two main sources; either vitamin D supplement intake or skin endogenous synthesis through UVB radiation. The different seasons adjusted best model fit with age serving as a sunlight proxy. Based on vitamin D level stratified by seasons and skin color, in summer a vitamin D level was higher observed in pregnant women compared to winter. Also, vitamin D levels was higher in summer in general population [26], and higher vitamin D levels was found in summer in pregnant women considering all the statistical significance [27].

Age was observed to be an important parameter and covariate in pregnant women. Higher vitamin D levels were reported in older pregnant women. Though, no significant difference has been observed. Vitamin D and age had a contradictory relationship as reported by various studies. The reason for association between vitamin D levels and age could be the consciousness in older women regarding health than younger pregnant women [28].

Although women enrolled in the present study came from various cities which endorsed different skin color pigmentation. Certain parameters such as women's physical activities, veiling, and food (fish) intake were not included in the analysis. The sample size was too small for measuring the statistical significance regarding vitamin D deficiency and skin color in first trimester pregnant women. Finally, it was a single centered study done in hospital which limits the generalizability of our findings. Yet, mostly women attending our clinical pregnancy controls belonged to general population.

CONCLUSION

The present study found that the prevalence of vitamin D deficiency in pregnant women was 53.5%. The differences in prevalence and 25-OH vitamin D levels mainly rely on maternal skin color, highlighting the need for supplementation programs and consequent screening for pregnant women particularly, among dark-skinned pregnant women.

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