

ORIGINAL ARTICLE

Frequency of Vitamin D Deficiency in Pre-Eclamptic Women

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ABSTRACT

Aim: To determine the frequency of vitamin D deficiency in pre-eclamptic women admit in tertiary care hospital of Sindh Pakistan.**Study design:** Cross sectional study.**Place and duration of study:** Department of Obstetrics & Gynaecology, Liaquat University of Medical & Health Sciences Hospital Hyderabad from 1st December 2020 to 30th May 2021**Methodology:** One hundred and fifty seven women with pre-eclampsia after 20 weeks of gestation were included. Detailed medical and obstetrical history and physical examination was carried out. Urine sample (MSU) was sent for test of proteinuria and after the confirm diagnosis of pre-eclampsia, blood sample was taken and sent to laboratory for measurement of serum Vitamin D (25(OH) D) levels and patients was categorized as Vitamin D deficient (below 75nmol/L (or 30ng/ml) of serum/plasma 25(OH)D concentration) or sufficient on the basis of serum vitamin D levels.**Results:** The average age was 29.06±3.96 years. Frequency of vitamin D deficiency was found in 130(82.8%) patients while sufficiency was found in 27(17.2%) of pre-eclamptic women.**Conclusion:** Pre-eclamptic women had a higher frequency of vitamin D deficiency. It is suggested that pregnant women at risk of vitamin D deficiency can be protected from hypertensive disease during pregnancy by a simple step of vitamin D supplementation during pregnancy.**Keywords:** Hypertensive disorders, Vitamin D deficiency, Pre-eclamptic

INTRODUCTION

Hypertensive disorders during pregnancy are a major cause of severe maternal and fetal morbidity, long-term disability, and mortality. An estimated 10% of pregnant women worldwide have hypertensive problems, which poses a major risk to the health of both the mother and the foetus^{1,2}. Preeclampsia is a condition that can occur after 20 weeks of pregnancy and is characterized by high blood pressure (BP≥140/90mmHg) and proteinuria. This syndrome occurs in 2-8% of pregnancies and accounts for 25% of perinatal morbidity and mortality worldwide³.

Various factors responsible for increasing the prevalence of the disease include: obesity, diabetes, impurity, chronic kidney diseases, chronic hypertension before pregnancy, immune disorders, family history of pre-eclampsia, twin or multiple pregnancy and Personal history of preeclampsia in a previous pregnancy.⁴ Preeclampsia's aetiology has been thought to be primarily influenced by the placenta, a specialised organ of pregnancy.⁵ Possible pathogenesis includes abnormal placentation and activation of the inflammatory system⁶. Vitamin D is essential for controlling the pathways involved in the development of pre-eclampsia⁷. All across the world, vitamin D insufficiency is extremely common, and pregnant women and newborns are particularly sensitive to it⁸. Early pregnancy low maternal blood vitamin D concentrations have been linked to a higher risk of pre-eclampsia. According to a study conducted in 2007, pre-eclamptic women had 2.5 times more chances of vitamin D deficiency in early pregnancy⁹. Another study in year 2018 documented vitamin D deficiency in 72%, while vitamin D insufficiency in 6% of its pre-eclamptic cases population¹⁰. Thus several studies have proven relationship between maternal vitamin D status and preeclampsia and an association between maternal vitamin D deficiency and increase risk of severe preeclampsia noted^{8,11} but still conclusion is debatable as not all studies have proven this association.

This study aims to determine the frequency of vitamin D deficiency in pre-eclamptic women, so that it might help us to search the pathogenesis of the pre-eclampsia, as understanding the pathogenesis of this disease may not only be of potential value for clinician and health policy makers in our hospital but may also provide more insights to clinical and research communities nationally and internationally. As searching the pathogenesis can

help us to propose better and effective preventive strategies for this most common medical disorder of pregnancy. Moreover the results will also be shared in various health oriented seminars for proper preventive strategies making and improving the fetomaternal health.

MATERIALS AND METHODS

This study is a cross-sectional study conducted during the time period of 1st December 2020 to 30th May 2021 in Obstetrics & Gynaecology at Liaquat University of Medical & Health Sciences Hospital Hyderabad. Permission was granted by LUMHS Ethical Review Board. Patients admitted with pre-eclampsia after 20 weeks of gestation, 20-35 years, all parity (nulliparous to grand-multiparous) with singleton pregnancy, house wives or indoor workers were considered. Detailed medical and obstetrical history and physical examination including BMI (kg/m²), blood pressure measurement (2 readings 4 hours apart in sitting position), rest of general physical and obstetric examination were carried out, baseline investigations including full blood count, blood group and RH factor, random blood sugar and urine sample (MSU) was sent for test of proteinuria and after the confirm diagnosis of pre-eclampsia, blood sample was taken and sent to laboratory for measurement of serum Vitamin D (25(OH)D) levels and patients were categorized as Vitamin D deficient (below 75nmol/L (or 30ng/ml) of serum/plasma 25(OH)D concentration) or sufficient on the basis of serum vitamin D levels. Patient occupation, residency (rural/urban), education status, antenatal care (booked/unbooked), socioeconomic status (low class having income upto 20000 rupees/month or middle class having income 20000-60000/month), parity, gestational age at diagnosis (calculated from 1st trimester ultrasound scan or LMP) of pre-eclampsia, proteinuria, serum vitamin D levels was noted and data was collected. This study is relevant and specific towards its objectives and proper exclusion criteria (women with history of vitamin D deficiency prior to pregnancy or patients taking vitamin D supplementation, medical disorders that increase the risk of pre-eclampsia like diabetes, chronic hypertension, smokers and obese or underweight women (BMI >30kg/m² or <18kg/m²) and outdoor working women was used to control any bias/confounder or effect modifier.

RESULTS

The average age was 29.06±3.96 years (range: 21-35). Similarly mean weight, height, BMI and gestational age of the women are

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shown in Table 1. There were 61.85% women multigravida and 38.2% primigravida. 56.7% were booked and 43.3% un-booked cases, residential status, education and socio economist status are almost same. Most of the women were house wife. The average vitamin D level was 18.46±9.89 nmol/l. The women who had 2+ proteinuria levels were 55.4%, 3+ proteinuria 32.5% and 4+ were observed in 12.1% cases. Frequency of vitamin D deficiency in 82.8% (130/157) while sufficiency in 17.2% (27/157) of pre-eclamptic women (Table 1).

Rate of vitamin D deficiency was not statistically significant with age group, gravidity and booking status while it was statistically significant with gestational age (p=0.00005) as shown in table 2. Rate of vitamin D deficiency was significantly high in urban resident, educated women and middle class women as shown in table 2. Rate of vitamin D deficiency was significantly high with those women who had high proteinuria (p=0.005) [Table 2].

Table 1: Pre-eclamptic status

Variable	Mean±SD
Age (years)	29.06±3.96
Weight (kg)	55.75±6.30
Height (cm)	1.563±0.07
BMI (kg/m ²)	22.78±1.47
Gestational age (weeks)	31.73±2.72
Blood Pressure	
Systolic BP (mmHg)	150.32±7.10
Diastolic BP(mmHg)	102.36±4.25
Vitamin D Level ng/ml	18.46±9.89
Proteinuria	
2+	87 (55.4%)
3+	51 (32.5%)
4+	19 (12.1%)
Frequency of vitamin D deficiency in pre-eclamptic women	
Sufficient	27(17.20%)
Deficient	130(82.80%)

Table 2: Frequency of vitamin D deficiency in pre-eclamptic women stratified by demographic and other modifiers (n=157)

Variables	VITAMIN D STATUS				TOTAL	P-Value
	DEFICIENT		SUFFICIENT			
	No.	%	No.	%		
Age (years)						
≤30	75	79.8%	19	20.2%	94	0.221
>30	55	87.3%	8	12.7%	63	
Gestational age (weeks)						
≤30	44	68.8%	20	31.3%	64	0.005
>30	86	92.5%	7	7.5%	93	
Gravida						
Primigravida	53	88.3%	7	11.7%	60	0.149
Multigravida	77	79.4%	20	20.6%	97	
Booking status						
Booked	70	78.7%	19	21.3%	89	0.115
Un-booked	60	88.2%	8	11.8%	68	
Residential status						
Rural	58	75.3%	19	24.7%	77	0.015
Urban	72	90.0%	8	10.0%	88	
Occupation						
House Wife	114	80.9%	27	19.1%	141	0.058
Working	16	100%	-	-	16	
Education						
Uneducated	59	75.6%	19	24.4%	78	0.018
Educated	71	89.9%	8	10.1%	79	
Socioeconomic status						
Low	64	77.1%	19	22.9%	83	0.045
Middle	66	89.2%	8	10.8%	74	
High	0	0.0%	0	0.0%	0	
Frequency of vitamin D deficiency in pre-eclamptic women according to proteinuria status						
2+	60	69.0%	27	31.0%	87	0.005
3+	51	100%	-	-	51	
4+	19	100%	-	-	19	

DISCUSSION

In Pakistan, preeclampsia and eclampsia are one of the major maternal causes, responsible for death of one in 89 women¹². Worldwide about 2% to 8% of pregnant women suffer from preeclampsia¹³. Almost 90% of the women in Pakistan are deficient in vitamin D¹⁴. In pregnancy, vitamin D deficiency ranges from 5% to 84% globally¹⁵. In this study the average age of the women was 29.06±3.96 years. In Umar et al study¹⁶ average age of both groups was 25 years and average BMI was 22kg/m².

In this study, frequency of vitamin D deficiency was 82.8% while sufficiency was 17.2% of its pre-eclamptic women. This finding is consistent with a recent study of a small group of pregnant women studied in Karachi, Pakistan by Hossain et al¹⁴ who found that almost 90% of pregnant women were vitamin D deficient. This high prevalence of vitamin D deficiency may be because we included pregnant women in this study who were not taking vitamin D supplements and calcium, with low socioeconomic status and poor diet, not fortified with calcium and vitamin D. In addition, they were housewives who spent maximum time indoor and therefore, having less sun exposure. In addition, all blood samples were collected in March and April, i.e. approximately the end of winter. So the season of sampling might have affected vitamin D levels. Higher incidence of preeclampsia in winter and a lower incidence in summer also suggest a possible role of vitamin D and sunlight¹⁷.

Women who had less than 50nmol/l (20ng/ml) of 25 (OH) D3 had a 4-fold risk in severe preeclampsia by Baker et al¹⁸. In 2010, Shin et al¹⁹ reported that enough vitamin D intake during pregnancy is necessary for the mother and child health and they demonstrated that the placenta produces vitamin D, which controls implantation, cytokine synthesis, and the immunological response to infection. In 2011, Dror²⁰ suggested that vitamin D has a role in preeclampsia because molecular pathways involved in pathogenesis of preeclampsia are under influence of vitamin D. In 2011, Ringrose²¹ in a case control study of 78 women near term with two readings of blood pressure above 140/90mmHg and 109 controls found women more likely to have hypertension with low circulating 25 (OH)D3 concentrations.

This discrepancy can be due to several reasons. In this study, serum 25 (OH)D concentrations were measured at a mean of 30 weeks of gestation compared with a mean of 10 weeks of gestation in the study of Bodnar et al²², Haugen et al²³ found more reduction in preeclampsia (OR 0.81,95% CI 0.68-0.97) in women who had taken vitamin D supplements for three-time points (pre-pregnancy, in early pregnancy and in late pregnancy) as compared to women who had taken supplements only in early or either late pregnancy (OR 0.87, 95% CI 0.75-1.02) and women who had not taken vitamin D supplements at all.

In this study, the evaluation of the potential role of vitamin D status in the development and progression of preeclampsia during early pregnancy was limited. Measurement of 25(OH)D in this

study was done after preeclampsia had developed, so reverse causality could not be ruled out. Genetic differences in vitamin D metabolism could be the possible explanation for these inconsistent findings. Heterogeneity in effects by race and/or vitamin D receptor genotype could have been explored. To improve power of findings, there is need for additional studies with the large sample size. There was no assessment of preconception and early pregnancy dietary intake or maternal baseline 25(OH)D, because these patients were enrolled at the time of diagnosis of preeclampsia. So the impact of these factors on the development of preeclampsia could not be determined. Levels of vitamin D at different gestations associated with both adverse maternal and infant outcomes should be determined in a longitudinal cohort study.

CONCLUSION

High frequency of vitamin D deficiency in our pregnant women presented with pre-eclampsia. Present study establishes a consistent association of maternal serum vitamin D deficiency with preeclampsia. Therefore it is suggested that all our pregnant women should have the facility to check their vitamin D status in early pregnancy particularly those who are at increased risk of having deficient vitamin D status like housewives, indoor workers, low socioeconomic status and those who found deficient should have vitamin D supplements. By this measure we can effectively prevent pre-eclamptic and its associated complications in maternal and fetal health.

Conflict of interest: Nothing to declare

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