

Original article:

A study on Vitamin D deficiency in pregnancy , the risk factors and its association with pregnancy induced hypertension.

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Abstract:

Background: Vitamin D is a fat soluble hormone produced in the skin by exposure to UV rays and undergo hydroxylation in liver and kidney to its active form. Vitamin D has various cellular and metabolic functions in the body . it is also recognised that it has various role in pregnancy and fetal well being. Vitamin D deficiency is associated with adverse pregnancy outcomes . This study aims at evaluating the association of Pregnancy induced hypertension (PIH) and Vitamin D deficiency and the risk factors associated with low serum vitamin D levels in pregnant females.

Methods: 102 pregnancy induced hypertension patients (PIH) and 54 age and body mass index matched healthy pregnant females as controls were included in the study. Their serum vitamin D levels are measured and are compared for statistical significance. The role of various risk factors of Vitamin D deficiency like maternal age , body mass index , parity , socioeconomic status and occupation were also analysed for significance.

Results: The mean serum Vitamin D level in pregnant females with PIH is significantly lower (P = 0.0011) when compared with age and BMI matched healthy pregnant females without hypertension. The Vitamin D levels decreases significantly with increase in maternal age , increase in body mass index , increase in parity and decrease in socio economic status.

Conclusion: Serum vitamin D deficiency is an important risk factor for the pregnancy induced hypertension. The risk factor for vitamin D deficiency among pregnant women are increasing maternal age , obesity , multiparity and low socioeconomic status.

Key words: Vitamin D , Pregnancy induced hypertension , Socioeconomic status , obesity.

Introduction:

Vitamin D is a fat soluble steroid hormone. It was discovered in early 20th century¹. Vitamin D exists in two forms. Vitamin D₃ or Cholecalciferol in animals and Vitamin D₂ or Ergocalciferol in plants^{2,3,4}. Vitamin D₃ is produced in human skin due to interaction of ultraviolet rays with the cholesterol derivatives in the skin. The Vitamin D₃ thus produced undergo hydroxylation in liver and kidney to form 1,25 (OH) Vitamin D₃⁵. After hydroxylation

Vitamin D binds with the Vitamin D receptors present in various cells and tissues to exert multiple functions like bone metabolism, cell growth, cell differentiation ,glucose metabolism and immune functions.

Vitamin D receptors are also located in placenta and therefore has a role in pregnancy and its outcome⁶. Vitamin D deficiency in pregnancy is found to be associated with pre eclampsia , gestational diabetes,

low birth weight , cesarean section , pre term delivery and infectious complications⁷.

In this study we studied the association of Pregnancy induced hypertension (PIH) and Vitamin D deficiency and the risk factors associated with low serum vitamin D levels in pregnant females.

Materials and methods :

This is a cross sectional study which included 102 pregnancy induced hypertension patients (PIH) and 54 age and body mass index matched healthy pregnant females as controls. PIH is defined as pregnant females with BP above 140/90 mm Hg after 20 weeks of pregnancy. Pregnant females with high BP before 24 weeks are not included in the study.

$$\text{BMI} = \text{Weight (kg)} / \text{Height}^2 \text{ (m)}$$

5ml of venous blood was drawn into EDTA tubes, plasma was separated by centrifugation. Serum 25 (OH) Vitamin D level was estimated using Electrochemiluminescence immune assay. Participants vitamin D level of ≥ 30 ng / ml considered as sufficient and those with < 30 ng/ml were considered as deficient.

Analysis:

The mean serum Vitamin D values of the PIH patients was compared with that of the healthy controls using unpaired students t test . To study influence of risk factors like age, BMI, Parity, socioeconomic status and occupation ANOVA and unpaired students t test were used. The statistical analysis was done using the Statistical Package for Social Sciences software version 17.

Hypertensive pregnant females with other complications like gestational diabetes, heart disease complicating pregnancy and those who are on chronic medications for any other illness are excluded from the study.

After acquiring informed consent from the participants detailed history regarding age, parity and occupation were obtained. The socioeconomic status was estimated using the “Modified (2007) Kuppaswamy Scale “. The pre-pregnancy height and weight of the participants were obtained from the antenatal case records and the Body mass index was calculated using the formula

Results:

Table 1 :Age , BMI and Vit D levels of PIH patients Vs healthy controls :

	With PIH	Without PIH	Odds ratio	P value
Vit D sufficient (> 30 ng/ ml)	21	22	2.652	0.0083
Vit D deficient (< 30 ng / ml)	81	32		

Table 2 : PIH in Vit D deficient patients

	PIH patients (n = 102)	Healthy controls (n = 54)	P value	significance
Age (years)	23.17 ± 2.02	23.15 ± 2.27	0.9584	Not significant
BMI (kg / m ²)	22.70± 1.79	21.80 ± 4.72	0.0906	Not significant
S.Vit D (ng / ml)	27.63 ± 7.69	23.31 ± 7.73	0.0011	Significant

Table 3 : Risk factors of Vit D deficiency – Age and BMI

S.No	Risk Factors						
1	Age	Mean Vit D (ng/ ml)	20 – 22 yrs	22 – 24 yrs	24 - 26 yrs	26 – 28 yrs	P value < 0.0001
			31.67 ± 4.76	23.68 ± 4.89	19.59 ± 2.69	11.68 ± 3.26	
2	BMI	Mean Vit D (ng/ ml)	< 23 (kg / m²)		> 23(kg / m²)		P value < 0.0001
			29.54 ± 5.31		18.32 ± 6.22		
3	Parity	Mean Vit D (ng/ ml)	Para1	Para 2	Para 3		P value < 0.0001
			30.83 ± 4.84	21.90 ± 5.33	14.32 ± 5.13		
4	Socioeconomic status	Mean Vit D (ng/ ml)	SES 1	SES 2	SES 3	SES 4 & 5	P value < 0.0001
			35.46 ± 5.91	29.31 ± 4.13	21.24 ± 5.04	15.37 ± 5.15	
5	Occupation	Mean Vit D (ng/ ml)	Housewives		Working women		P value 0.9867
			24.82 ± 8.47		24.80 ± 7.53		

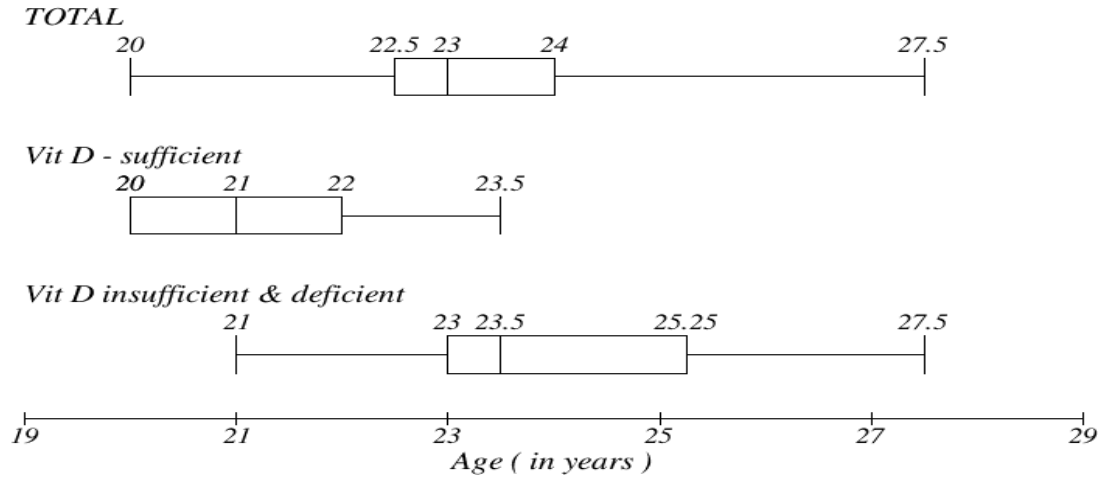


Fig 1 : Vitamin D and Maternal age

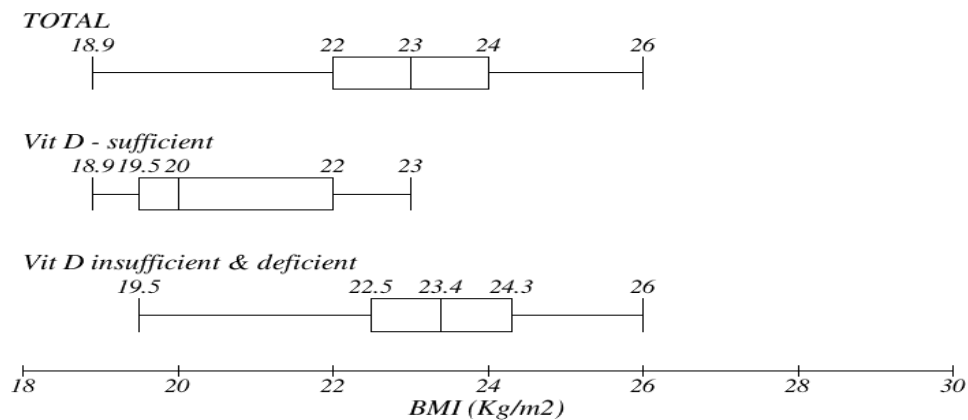


Fig 2 : Vitamin D and body mass index (BMI)

Discussion:

The mean serum Vitamin D level in pregnant females with PIH is significantly lower ($P = 0.0011$) when compared with age and BMI matched healthy pregnant females without hypertension. The Vitamin D deficiency as defined as < 30 ng / ml is a significant risk factor for PIH (Odds ratio 2.652 ; $p = 0.0083$) . In the study by Piotr Domaracki ⁸ among 207 pregnant polish women , there was a significant difference in the serum Vitamin D levels in women with PIH and the control group (14.75 Vs 22.10 ng /

ml ; $p = 0.0021$) . In a study by Barbring et al⁹ there was an inverse relation between the occurrence of pre eclampsia and serum Vitamin D levels.

The mechanism by which Vitamin D deficiency causes increase in blood pressure in pregnant women is not clearly known but studies suggest the mechanism may be linked to low levels of vascular endothelial growth factor (VEGF) and high levels of inflammatory cytokines ¹⁰⁻¹³. Similar association between serum Vitamin D and pre eclampsia is also shown in studies by Pena et al ¹⁴ and Mohaghen et al

¹⁵ . Placental dysfunction caused by low levels of Vitamin D may also contribute to PIH as suggested by some studies ¹⁶.

Risk factors of vitamin D deficiency :

Maternal age :

In our study , increasing maternal age shows a significant decrease in serum Vitamin D levels (P , 0.0001)

Body mass index :

The mean Vitamin D level is significantly is significantly higher in patients with BMI < 23 kg / m² when compared with those with BMI > 23 kg / m². (29.54 Vs 18.34 ng / ml ; P , 0.0001). Similar association was also found in studies by Arunabh et al¹⁷ , ortegan et al¹⁸ and Mc Kinney et al¹⁹ among non pregnant women. Studies by Perez Lopez et al²⁰ Zhang et al²¹ and Yu et al²² among pregnant women also showed similar association .

The association between obesity and Vitamin D deficiency is due to that , though the production of 7-Dehydrocholesterol is normal the increased fat tissue in obese modify the release of 7-Dehydrocholesterol from skin to systemic circulation²³.

Parity :

Vitamin D levels reduces significantly with increasing parity. Similar association was also seen in

studies from Jordan²⁴ and among Swiss mothers²⁵ . Study by Narchi et al²⁶ did not show any such association.

Socioeconomic status :

In our study there was a positive association between the socioeconomic status as calculated by modified (2007) Kuppaswamy scale and serum Vitamin d levels. Many studies show the low serum vitamin D levels among pregnant women of low socioeconomic status^{27,28,29}.

Occupation :

Housewives are at increased risk of Vitamin D deficiency because of their low exposure to sunlight. In our study the serum Vitamin D level did not show any significant difference between the working women and housewives.

Conclusion :

Serum vitamin D deficiency is an important risk factor for the pregnancy induced hypertension. The risk factor for vitamin D deficiency among pregnant women are increasing maternal age , obesity , multiparity and low socioeconomic status. Being a housewife does not increase the risk of vitamin D deficiency among pregnant females.

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