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# The Study of Serum Calcium and Vitamin D Levels in Preeclampsia and Pregnancy Induced Hypertension

**Dr. Divya Sinha[1], Dr. Sourabh Shrivastava[2*]**
[1]Consultant, Department of Obstetrics & Gynaecology at ESI Hospital, Gwalior, Madhya Pradesh, India
[2]Consultant, Department of Anesthesia at Kalyan Memorial Hospital, Gwalior, Madhya Pradesh, India

**Original Research Article**

***Corresponding author**
*Dr. Sourabh Shrivastava*

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**Abstract:** Recent evidences suggest a high prevalence of calcium and vitamin D deficiencies in preeclamptic women. However, level of these parameters in pregnancy induced hypertension has not been studied thoroughly. So the present study aimed to evaluate the level of serum calcium and vitamin D in preeclampsia and pregnancy induced hypertension and also to assess the comparison between both groups to determine which group possess higher deficiency. Total numbers of 60 cases were taken in the study in which 30 cases were of preeclamptic women and 30 were pregnancy induced hypertension. Fasting serum sample was taken for the analysis of calcium and vitamin D level by o-cresol Phthalene complexone method with Erba model Chem 5 plus and commercial ELISA kit. The serum calcium and vitamin D levels were found statistically significantly lower in preeclamptic women than pregnancy induced hypertension. Other anthropogenic measurements were found no difference in both groups. Low levels of serum calcium and vitamin D levels may lead to poor pregnancy outcomes i.e. from pregnancy induced hypertension to severe preeclampsia.
**Keywords:** Preeclampsia, Pregnancy Induced Hypertension (PIH), Pregnancy, Vitamin D, Calcium.

## INTRODUCTION

Disorders of calcium metabolism, including hypocalcaemia and low vitamin D level, have been consistently described, during in the course of pregnancy of women who later developed preeclampsia and PIH [1-3].

Calcium is an essential nutrient, [4] and improves metabolic function, bone health, and neuromuscular function [5].The total concentration of calcium reduces during pregnancy, because of increases in plasma volume, increased glomerular filtration, and maternal-fetal calcium transport. Calcium and vitamin D deficiency is very common in pregnant women and infants [6-7] and is an epidemic phenomenon worldwide [8].

Preeclampsia (PE) is a disease specific to pregnancy, affecting many bodily systems, characterized by high blood pressure and proteinuria after the 20th week of pregnancy, complicating 2-8% of pregnancies and increasing maternal and fetal mortality and morbidity [9-11]. Vitamin D deficiency during pregnancy has been linked with a number of serious short- and long-term health problems in offspring, including impaired growth, skeletal problems, and type

1 diabetes, asthma, and schizophrenia [12]. In PIH (high blood pressure and no proteinuria) also there is a role of Vitamin D and serum calcium level. Yet few investigators have explored the role of maternal vitamin D status in adverse pregnancy outcomes. So, the aim of the study is to evaluate the level of serum calcium and vitamin D in preeclampsia and pregnancy induced hypertension and also to assess the comparison between both groups to determine which group possess higher deficiency.

## MATERIALS AND METHODS

The present study comprises two groups – preeclamptic group having 30 subjects and pregnancy induced hypertensive group having 30 subjects. The study was approved ethically and by patient consent. The inclusion criteria of the study were:

Primigravida of age 20 to 34 years with singleton live pregnancy who crossed 33 weeks of gestation and who had developed hypertension only after 20 weeks of gestation

Patient had been labeled as gestational hypertension when high levels of blood pressure were

found on 2 occasion's at least 6 hours apart while patient was in bed rest.

Group A: In present study patient with severe preeclampsia has been included

Criteria to diagnose severe preeclampsia are:

- Systolic blood pressure of ≥ 160 mmHg and diastolic blood pressure of ≥ 110 mmHg.
- Proteinuria of ≥ 5 gm in 24 hour urine specimen and 3+ or greater on dipstick test at 2 random urine samples collected 4 hours apart.
- Oliguria
- Visual disturbance
- Pulmonary edema
- Epigastric or right hypochondrial pain
- Impaired liver function
- Thrombocytopenia
- Fetal growth restriction

Group B: pregnancy induced hypertension was diagnosed when systolic blood pressure more than or equal to 140 mmHg and diastolic blood pressure more than or equal to 90 mmHg without proteinuria.

**Exclusion criteria**

Elderly primigravida, teenage pregnancy, multigravida, multiple pregnancy, IUD, pregnancy with other complications like hypothyroidism, GDM, women who had preexisting disease like essential hypertension, DM type II, renal disease etc

Fasting serum sample was collected for analysis. Serum calcium level was measured by o-cresol Phthalene complexone method with Erba model Chem 5 plus. Vitamin D level was analyzed by using commercial ELISA kit from Immunodiagnostic Systems Limited (IDS, Tyne, UK).

**STATISTICAL ANALYSIS**

Data was expressed as Mean±SD. Statistical analysis was done by using SPSS software version 22.0. The comparison between both groups was evaluated by Student independent t test. P value less than 0.05 was considered as significant.

**RESULTS**

Different parameters was observed in this study like age, BMI, Systolic /diastolic BP, protein in urine (diagnostic to differentiate between both groups),serum Calcium and Vitamin D level. The Mean ±SD of different parameters observed were shown in the Table no-1. There were found no statiscally significant difference between both groups in respective of age.

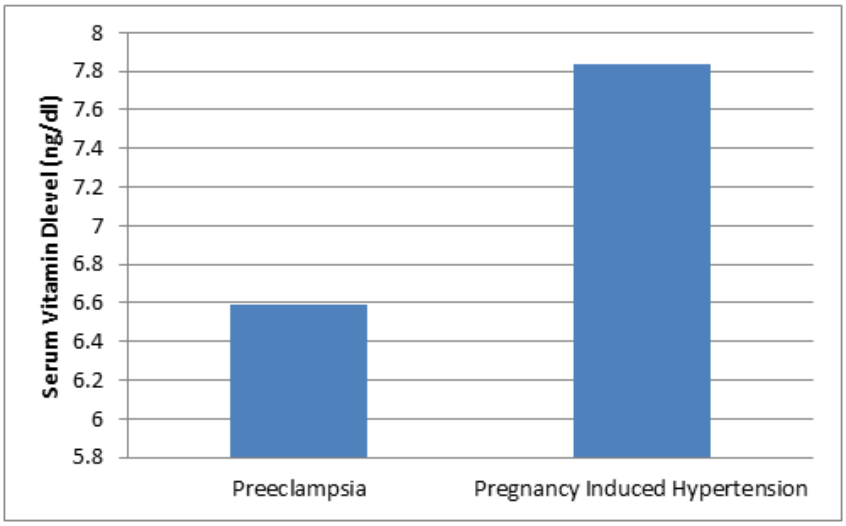
We found statistically significantly lower levels of serum Vitamin D levels (32.0±3.0, $p<0.05$) in preeclamptic subjects as comparison to pregnancy induced hypertensive subjects (Table1, Graph 1).

Likewise, serum calcium was also found statistically significantly lower (6.59±0.05, $p<0.05$) in preeclamptic subjects as comparison to pregnancy induced hypertensive subjects (Table1, Graph 2).

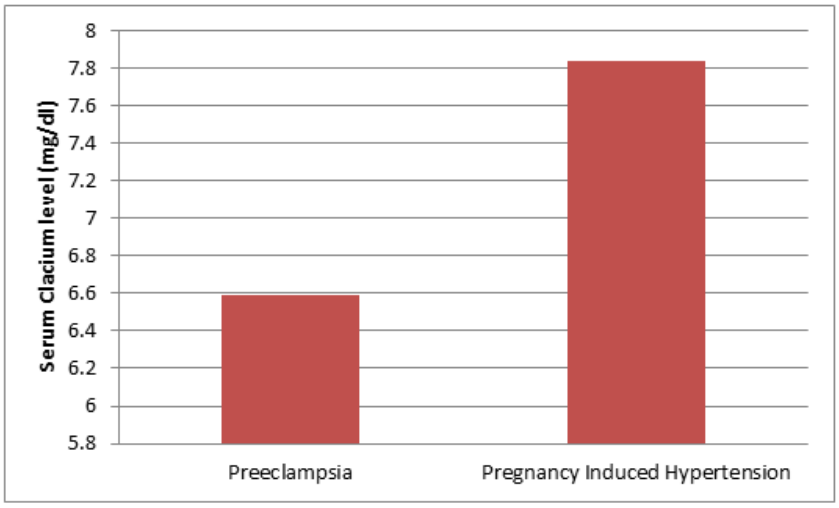
**Table-1: Showing the parameters comparison between both groups**

| S.No. | Parameters | Unit | Preeclamptic Subjects (Group A) | Pregnancy Induced Hypertensive subjects (Group B) |
|---|---|---|---|---|
| 1 | Age | Years | 26.0±7.0 | 24.2±3.25 |
| 2 | Body Mass Index | $Kg/m^2$ | 27.08 ±3.07 | 24.6±2.32 |
| 3 | Systole | mmHg | 170± 5.00 | 144±3.00 |
| 4 | Diastole | mmHg | 120± 4.01 | 92±6.15 |
| 5 | Protein (urine) | gm | +++ | Nil |
| 6 | Vitamin D | ng/ml | 32.0±3.0* | 37.5±2.0 |
| 7 | Calcium | mg/dl | 6.59±0.05* | 7.84±0.87 |

*Significant ($P<0.05$)




**Graph-1: showing the comparison of vitamin D level in preeclamptic and Pregnancy Induced Hypertensive subjects**




**Graph–2: showing the comparison of serum Calcium level in preeclamptic and Pregnancy Induced Hypertensive subjects**

## DISCUSSION

Growing fetus imposes a considerable burden on mother homeostasis of calcium. During pregnancy, the fetus obtains about 30 grams of calcium and 80% of it deposited in fetus bones in the third trimester of pregnancy. This need is met mainly by increasing intestinal calcium absorption by the intestines of mother that mediated by 1**,** 25-dihydroxyvitamin D*3.* During pregnancy calcium needed for fetal development and lactation may be at least partially withdrawn from the mother's skeleton [13].Therefore, in our study we also found serum calcium level statistically significantly lower ($6.59 \pm 0.05$, $p<0.05$) in preeclamptic subjects as comparison to pregnancy induced hypertensive subjects (Table1, Graph 2). Our study is in accordance with Kanagal *et al*. [14] while in another study Darkwa *et al*. serum calcium and magnesium level were not found significantly lower in preeclamptic women [15].

Vitamin D3, also known as calciferol, is a prohormone that plays an important role in calcium homeostasis and bone health in addition to its neuromuscular functions [16]. Several studies reported the relationship between maternal Vitamin D deficiency and adverse maternal and fetal outcomes [17]. In the last two decades, the non-classical function of Vitamin D has been suggested; it regulates a large number of human genes (~200 genes), resulting in a wide range of autocrine effects in different tissues [18]. For example, Vitamin D is involved in regulation of cell proliferation, cell differentiation, and apoptosis [19]. It exerts immune responses through regulation of the innate and adaptive immunity. This explains the correlation of vitamin D deficiency to the potential risk of a series of conditions like hypertensive disorders, diabetes mellitus, cancer, multiple sclerosis, allergy, asthma, autoimmune and infectious diseases as well as depression [20]. In our study we found We found

statistically significantly lower levels of serum Vitamin D levels (32.0±3.0, $p<0.05$) in preeclamptic subjects as comparison to pregnancy induced hypertensive subjects (Table1, Graph1).This observations were in consistent with the studies of Sasan *et al*. [21], Charandabi *et al*. [22], Bodnar *et al*. [23].

So from this study we observed that the serum calcium and vitamin D levels were found statistically significantly lower in preeclamptic women than pregnancy induced hypertension. Other anthropogenic measurements were found no difference in both groups.

## CONCLUSION

From this study we can conclude that low levels of serum calcium and vitamin D levels may lead to poor pregnancy outcomes i.e. from pregnancy induced hypertension to severe preeclampsia. Thus, women who are at higher risk of preeclampsia should be supplemented with calcium vitamin D. However further studies are required to prove the role of these parameters in preeclampsia and PIH.

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