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Vitamin D Level in Preeclampsia and Eclampsia and Its Correlation with Fetomaternal Outcome

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Abstract

Aim: The aim of the study is to evaluate the levels of vitamin D in pregnant women with preeclampsia and eclampsia and to investigate its correlation with fetomaternal outcomes, including maternal complications and neonatal health parameters.

Materials and methods: The study included 100 pregnant women beyond 28 weeks of gestation with singleton pregnancies. Women with multiple pregnancies, diabetes, or chronic health conditions were excluded. Routine investigations, including fasting lipid profiles and a 75g glucose screening test (GST), were conducted. Lipid profile thresholds included total cholesterol <200 mg%, triglycerides <150 mg%, HDL 30–70 mg%, LDL <100 mg%, and VLDL 2–30 mg%. Gestational diabetes mellitus (GDM) was diagnosed using the DIPSI criteria (venous glucose >140 mg% post-GST), while pregnancy-induced hypertension, preterm labor, and intrahepatic cholestasis of pregnancy were diagnosed based on standard clinical and biochemical criteria. Statistical analyses were done using SSPS software.

Results: In the study of 30 healthy pregnant women, 35 preeclamptic women, and 35 eclamptic women, significant differences were observed in gestational age, blood pressure, fetal birth weight, and vitamin D levels. Gestational age at delivery was lower in preeclamptic (36.2±2.5 weeks) and eclamptic women (34.1±2.3 weeks) compared to healthy pregnancies (38.2±2.1 weeks, P<0.002). Both systolic and diastolic blood pressures were significantly elevated in preeclamptic (160/110.2 mmHg) and eclamptic women (160.1/112.3 mmHg) compared to healthy controls (117.2/65.2 mmHg, P<0.002). Fetal birth weights were significantly reduced in preeclamptic (2,112±712.22 g) and eclamptic women (2,654±702.1 g) compared to healthy pregnancies (3,662±621.45 g, P<0.002). Vitamin D levels were also markedly lower in preeclamptic (18.2±3.76 ng/ml) and eclamptic women (19.1±4.01 ng/ml) compared to healthy pregnant women (24.2±5.01 ng/ml, P<0.002).

Conclusion: The study establishes a significant association between low vitamin D levels and an increased risk of preeclampsia, eclampsia, and adverse fetomaternal outcomes. These findings suggest that vitamin D supplementation may help mitigate these risks, though further research is needed to fully understand its potential role in preventing or managing hypertensive pregnancy disorders.

Keywords: Preeclampsia, Eclampsia, Vitamin D

Introduction

Maternal vitamin D deficiency is a global public health issue affecting all socioeconomic groups. It has been linked to conditions such as hypertension, coronary artery disease, diabetes, autoimmune disorders, asthma, and certain cancers.[1,2] Pre-eclampsia, a pregnancy-specific syndrome, impacts 3–7% of first pregnancies and is highly prevalent in the Asian population, particularly among women with deeply pigmented skin or those who cover their bodies extensively. Vitamin D deficiency during pregnancy stems from inadequate sunlight exposure and insufficient dietary intake, even with prenatal vitamins containing 400 IU of vitamin D3.[3,4] While studies have shown an association between vitamin D deficiency and preeclampsia, with one reporting a 27% risk reduction with supplementation (400–600 IU daily), its link to eclampsia remains unexplored. Eclampsia, a severe complication of preeclampsia characterized by seizures, has been linked to low vitamin D levels. Adequate vitamin D may help reduce the risk of developing eclampsia, but further studies are needed to confirm its role in prevention and management.

The implications of maternal vitamin D deficiency extend beyond pregnancy complications, potentially impacting long-term maternal and neonatal health. Low vitamin D levels during pregnancy have been associated with adverse fetal outcomes, including low birth weight, preterm birth, and impaired skeletal development.[5] Given the role of vitamin D in modulating immune function and vascular health, its deficiency may exacerbate the pathophysiological processes underlying hypertensive disorders like preeclampsia and eclampsia. Addressing this deficiency through public health interventions, including targeted supplementation and education about sunlight exposure, could improve maternal and neonatal outcomes, particularly in high-risk populations.[6] The aim of the study is to evaluate the levels of vitamin D in pregnant women with preeclampsia and eclampsia and to investigate its correlation with fetomaternal outcomes, including maternal complications and neonatal health parameters.

Materials and methods

The study included 100 pregnant women beyond 28 weeks of gestation with singleton pregnancies. Women with multiple pregnancies, diabetes, or chronic health conditions were excluded. Routine investigations, including fasting lipid profiles and a 75g glucose screening test (GST), were conducted. Lipid profile thresholds included total cholesterol <200 mg%, triglycerides <150 mg%, HDL 30–70 mg%, LDL <100 mg%, and VLDL 2–30 mg%. Gestational diabetes mellitus (GDM) was diagnosed using the DIPSI criteria (venous glucose >140 mg% post-GST), while pregnancy-induced hypertension, preterm labor, and intrahepatic cholestasis of pregnancy were diagnosed based on standard clinical and biochemical criteria. Statistical analyses were done using SSPS software.

Results

Table 1:

	Healthy Pregnant (n=30)	Preeclampsia (n=35)	Eclampsia (n=35)	P value
Age(years)	25.2 ± 4.12	27.6 ± 6.23	27.1 ± 3.12	NS
Weight(kg)	75.2 ±10.22	73.1±9.76	72.13± 12.3	NS
Height(cm)	155.43±6.21	153.21± 12.3	158.21±10.2	NS
BMI(kg/m^2)	28.2±2.12	26.3±3.12	27.4±5.12	NS
Gestation (Weeks)	38.2±2.1	36.2±2.5	34.1±2.3	<0.002
Systolic blood pressure (mmHg)	117.2 (145-95)	160 (176-150)	160.1 (200-150)	<0.002
Diastolic blood pressure (mmHg)	65.2±7.21	110.2±5.21	112.3±7.31	<0.002
Fetal birth weight (g)	3.662±621.45	2.112±712.22	2.654± 702.1	<0.002
Vitamin D (ng/ml)	24.2±5.01	18.2±3.76	19.1±4.01	<0.002

In the study of 30 healthy pregnant women, 35 preeclamptic women, and 35 eclamptic women, significant differences were observed in gestational age, blood pressure, fetal birth weight, and vitamin D levels. Gestational age at delivery was lower in preeclamptic (36.2±2.5 weeks) and eclamptic women (34.1±2.3 weeks) compared to healthy pregnancies (38.2±2.1 weeks, P<0.002). Both systolic and diastolic blood pressures were significantly elevated in preeclamptic (160/110.2 mmHg) and eclamptic women (160.1/112.3 mmHg) compared to healthy controls (117.2/65.2 mmHg, P<0.002). Fetal birth weights were significantly reduced in preeclamptic (2,112±712.22 g) and eclamptic women (2,654±702.1 g) compared to healthy pregnancies (3,662±621.45 g, P<0.002). Vitamin D levels were also markedly lower in preeclamptic (18.2±3.76 ng/ml) and eclamptic women (19.1±4.01 ng/ml) compared to healthy pregnant women (24.2±5.01 ng/ml, P<0.002).

Discussion

Vitamin D plays a crucial role in maintaining overall health by regulating calcium and phosphorus metabolism, supporting immune function, and promoting vascular health. During pregnancy, the demand for vitamin D increases to support fetal skeletal development and maternal physiological changes. However, vitamin D deficiency is a widespread public health issue, particularly in regions with limited sunlight exposure, cultural practices that limit skin exposure, and inadequate dietary intake.[7]

Pregnancy-specific hypertensive disorders, such as preeclampsia and eclampsia, are significant contributors to maternal and perinatal morbidity and mortality. Preeclampsia, is characterized by hypertension and proteinuria after 20 weeks of gestation, and eclampsia, marked by the onset of seizures in women with preeclampsia, are associated with poor fetomaternal outcomes, including preterm birth, low birth weight, and stillbirth. Emerging evidence suggests that vitamin D deficiency may exacerbate the pathophysiology of these conditions by influencing vascular function, immune regulation, and placental development.[8]

Understanding the relationship between vitamin D levels and fetomaternal outcomes in preeclampsia and

eclampsia is crucial for identifying potential interventions to improve maternal and neonatal health outcomes. This topic has gained attention due to the potential of vitamin D supplementation to mitigate the adverse effects associated with these pregnancy complications.

A study conducted by Bakacak M et al.[9] aimed to evaluate vitamin D levels in eclamptic, preeclamptic, and healthy pregnant women, exploring the role of vitamin D deficiency in the etiology of preeclampsia (PE). The study included 40 healthy pregnant women, 83 preeclamptic women, and 32 eclamptic women. Maternal and infant medical records were reviewed, and blood samples were obtained from all participants. Demographic characteristics and serum vitamin D levels were compared among the groups. No significant differences were observed in age, gravidity, parity, weight, height, or BMI between the groups. However, gestational age at delivery and neonatal birth weight were significantly lower in eclamptic and preeclamptic women compared to healthy controls (P<0.001). Both systolic and diastolic blood pressures were markedly higher in the eclamptic and preeclamptic groups (P<0.001), and the rate of cesarean section was also significantly elevated (P<0.001). Vitamin D levels were found to be lower in preeclamptic and eclamptic patients compared to healthy pregnant women (P<0.001). No significant differences were noted between preeclamptic and eclamptic women in the parameters studied. The findings suggest that vitamin D supplementation may help reduce the risk of preeclampsia and eclampsia in populations at risk for vitamin D deficiency.

In our study, significant differences were observed between 30 healthy pregnant women, 35 preeclamptic women, and 35 eclamptic women in terms of gestational age, blood pressure, fetal birth weight, and vitamin D levels. Healthy pregnancies had a longer gestational age (38.2±2.1 weeks) compared to preeclamptic (36.2±2.5 weeks) and eclamptic women (34.1±2.3 weeks, P<0.002). Blood pressure was notably higher in both preeclamptic (160/110.2 mmHg) and eclamptic women (160.1/112.3 mmHg) compared to healthy controls (117.2/65.2 mmHg, P<0.002). Fetal birth weights were significantly lower in preeclamptic (2,112±712.22 g) and eclamptic women (2,654±702.1 g) compared to healthy women (3,662±621.45 g, P<0.002). Additionally, vitamin D levels were significantly lower in preeclamptic (18.2±3.76 ng/ml) and eclamptic women (19.1±4.01 ng/ml) compared to healthy pregnant women (24.2±5.01 ng/ml, P<0.002), suggesting a potential link between vitamin D deficiency and these hypertensive disorders in pregnancy.

In the study by Saini S et al.,[10] an observational analysis was conducted at a tertiary care center between January 1, 2020, and June 30, 2021, involving 120 pregnant women, with 60 diagnosed with preeclampsia (BP >140/90) and 60 healthy controls. The aim was to explore the relationship between vitamin D levels and preeclampsia, as well as assess fetomaternal outcomes. The results revealed that preeclamptic patients had significantly lower vitamin D levels compared to the healthy controls, with a p-value of <0.001, highlighting a strong association between vitamin D deficiency and preeclampsia. The study concluded that while a significant relationship exists between low vitamin D levels and preeclampsia, further research is needed to evaluate the effects of vitamin D supplementation on fetomaternal outcomes.

Chauhan, N et al.[11] conducted a study at the Himalayan Institute of Medical Sciences (HIMS) in Dehradun over

12 months to investigate the impact of vitamin D deficiency on feto-maternal outcomes. The study included 100 pregnant women attending the antenatal clinic. The results showed that 15 cases of pre-eclampsia occurred, with 23.80% of the deficient group, 13.04% of the insufficient group, and 10% of the sufficient group affected. Eclampsia was observed in 3 subjects, with 4.76% having deficient and 2.89% having insufficient vitamin D levels. Intrauterine growth restriction (IUGR) was seen in 8 subjects, all of whom had either deficient or insufficient vitamin D levels, with none in the sufficient group. Additionally, a higher incidence of low birth weight (≤2.5 kg) was found in the deficient group (42.85%) and the insufficient group (31.88%), with those having sufficient vitamin D levels showing better outcomes. The study concluded that vitamin D deficiency and insufficiency were prevalent and associated with an increased risk of pre-eclampsia, low birth weight, and a higher incidence of cesarean sections, highlighting the importance of addressing vitamin D deficiency during pregnancy.

Thereby our study underscores the significant correlation between low vitamin D levels and the increased risk of preeclampsia and eclampsia, along with adverse fetomaternal outcomes such as preterm delivery and low birth weight. While the findings suggest that vitamin D deficiency may play a role in the development of these hypertensive disorders in pregnancy, further research is essential to explore the potential benefits of vitamin D supplementation in preventing or managing preeclampsia and eclampsia. Understanding this relationship could guide clinical practices and improve maternal and fetal health outcomes.

Conclusion

In conclusion, the study establishes a significant association between low vitamin D levels and an increased risk of preeclampsia, eclampsia, and adverse fetomaternal outcomes. These findings suggest that vitamin D supplementation may help mitigate these risks, though further research is needed to fully understand its potential role in preventing or managing hypertensive pregnancy disorders.

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