



ROLE OF CALCIUM ON PREVENTION OF PREECLAMPSIA: A REPORT FROM A TERTIARY CARE CENTER IN BIHAR

Obstetrics and Gynecology

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ABSTRACT

Hypertension in pregnancy stand alone or with proteinuria is one of the leading causes of maternal mortality and morbidity in the world. Hypertensive disorders are the second most common cause of maternal deaths worldwide and account for more than 40,000 maternal deaths annually. **Methodology:** This hospital-based cross-sectional survey was conducted from May 2019 to July 2020 at the Department of Obstetrics and Gynecology, Jawahar Lal Nehru Medical College & Hospital, Bhagalpur, India. All registered pregnant women with a period of gestation of more than 28 weeks were eligible for inclusion in the study. Pregnant women with known history of hypertension before 20 weeks of gestation and those who refused to participate were excluded. In this way, a total of 198 women were included in the study. **Results:** Association of preeclampsia with serum calcium levels: A total of 29 (13.4%) pregnant women developed preeclampsia. Serum calcium level was not associated with preeclampsia, odds ratio (OR) 1.2 (95% CI 0.27-3.98). **Conclusions:** The dietary calcium intake only replenishes the stores and the serum calcium levels are maintained in a tight range. Knowledge regarding calcium intake and serum calcium level in community settings can help us better frame the policies and guidelines regarding calcium supplementation.

KEYWORDS

Preeclampsia, Role Of Calcium

INTRODUCTION

Hypertension in pregnancy stand alone or with proteinuria is one of the leading causes of maternal mortality and morbidity in the world [1]. Hypertensive disorders are the second most common cause of maternal deaths worldwide [2] and account for more than 40,000 maternal deaths annually [3]. These disorders are also associated with adverse perinatal outcomes such as stillbirth, preterm and small for gestational age babies [4-6].

Ninety nine percent of the total body calcium is in the bones and the remaining 1% is in the extracellular space. The recommended dietary allowance (RDA) is 1,200 mg/day for pregnant women.[7] Pregnancy is a state of increased demand for calcium, which should be met. Calcium homeostasis is finely regulated by a complex mechanism coordinated by a variety of hormones, the chief among them being vitamin D and parathyroid hormone. However, serum calcium levels have been shown to be consistently low among pregnant women.[8-11] The most important component of the regulation cycle is dietary calcium intake. So supplementing calcium in pregnancy may result in an elevation of the serum calcium level. Several complications during pregnancy have been attributed to the lower level of calcium. They include both maternal complications such as preeclampsia and poor bone formation in the mother, and fetal complications such as low birth weight, increased neonatal mortality, and high blood pressure in the child.[8, 10]

Some studies showed no effect of the serum calcium level on preeclampsia [8, 12, 13] while other studies showed an association of serum calcium level with preeclampsia.[13 - 18] There is limited evidence from community-based studies of rural India for serum calcium level and the incidence of preeclampsia. Therefore, the study aimed to document the association between serum calcium and preeclampsia in the third trimester of pregnancy.

Methodology

This hospital-based cross-sectional survey was conducted from May 2019 to July 2020 at the Department of Obstetrics and Gynecology, Jawahar Lal Nehru Medical College & Hospital, Bhagalpur, India. Ethical approval was obtained from the Institutional Ethics Committee. All registered pregnant women with a period of gestation of more than 28 weeks were eligible for inclusion in the study. Pregnant women with known history of hypertension before 20 weeks of gestation and those who refused to participate were excluded. All the patients who were eligible to be included in the study were approached and they were explained about the purpose of the study. Duly signed informed consent forms were collected from each study participant. In this way, a total of 198 women were included in the study.

pneumatic sphygmomanometer (Industrial Electronic & Allied Products, Pune, Maharashtra, India), with the pregnant women sitting comfortably as recommended by the British Hypertension Society and the Nurses Hypertension Association. A clean-catch urine sample was tested by dipstick at the first visit for albuminuria.[19] Preeclampsia was defined as a systolic blood pressure higher than 140 mmHg and a diastolic blood pressure higher than 90 mmHg on two occasions at least 4 h apart after 20 weeks of pregnancy in a woman with previously normal blood pressure, along with proteinuria [defined as N300 mg/24 h or $\geq 1+$ (on a clean-catch dipstick in the absence of urinary infection)].[20]

All the accumulated data was analyzed by the help of Social Package for Social Sciences by IBM (Ver 20). Simple descriptive statistics such as frequencies, proportions, and percentages were used to describe the demographic and clinical characteristics of participants. Univariate logistic regression statistical tests were performed to identify the independent associations and predictors of treatment outcome. At a 95% confidence interval, $p < 0.05$ was considered statistically significant in all tests.

RESULTS

Socio demographic characteristics: About 38.8% of the pregnant women were 21 years or below in age and 97.3% were homemakers. One-third of the pregnant women were illiterate while another 23.7% had studied till primary school and another 19.8% had studied till middle school [Table 1]. The mean height (SD) was 154.7 cm (6.31) and mean weight (SD) was 57.5 kg (8.1). Out of all, 35% were primigravida.

Table 1: Distribution of study participants according to socio-demographic variables

Variable	Categories	Percentage
Age	21 years or below	38.8%
	More than 21 years	61.2%
Education	Diploma and above	7.8%
	High school	11.1%
	Middle school	19.8%
	Primary school	23.7%
	Illiterate	37.6%
Occupation	Homemakers	97.3%
	Others	2.7%

Serum calcium level Of all the study participants, 88% pregnant women had serum calcium level of more than 9 mg/dL. The mean serum calcium level (SD) was 9.6 (0.56) mg/dL against the normal level of 9.0 mg/dL.

Association of preeclampsia with serum calcium levels: A total of 29

Blood pressure was measured at the first visit using a manual

(13.4%) pregnant women developed preeclampsia. Serum calcium level was not associated with preeclampsia, odds ratio (OR) 1.2 (95% CI 0.27-3.98). There was no significant difference in the mean serum calcium level between those who developed preeclampsia and those who did not.

DISCUSSION

The mean serum calcium level was 9.6 mg/dL with SD of 0.56 mg/dL. The mean serum calcium level was near the normal value of 9 mg/dL.[21] Other studies had reported a lower level of mean serum calcium. [8-10, 22-24] The reported lower level of serum calcium level could be explained by the fact that these studies were conducted in a hospital setting. Hence, the pregnant women were more likely to have deranged biochemical parameters. Kumar et al.[8] reported that the urban pregnant women were less exposed to sunlight. Rural women working outdoors are more likely to be exposed to sunlight for a longer period of time. Though most of the pregnant women in our study were homemakers, they also worked outside the confines of the house. Thus, they were likely to have received greater exposure to sunlight resulting in increased vitamin D production. This increase in vitamin D could lead to increase in serum calcium level. High phytate content in the diet hinders the absorption of calcium in the diet. We did not measure the phytate content of the diet. Hence, we are unable to comment on the role of dietary phytates on the findings related to serum calcium level.

The incidence of preeclampsia in the third trimester in pregnant women was 13.4%. There was no significant association between serum calcium level and the occurrence of preeclampsia in our study. However, many studies [12 - 18] have shown an association of preeclampsia with low serum calcium levels. Preeclampsia etiology is complex and depends on a number of factors. It has been shown that the main risk factor for preeclampsia is chronic hypertension. In our study, none of the pregnant women were diagnosed with chronic hypertension. Other studies were hospital-based and the severity of preeclampsia was likely to be higher in pregnant women visiting a hospital than those diagnosed in the community. The overall incidence of preeclampsia could have been underestimated in our study because we had visited the pregnant women only once between 28 weeks and 36 weeks. There was a possibility of the pregnant women developing preeclampsia after the visit. We made a concurrent measurement of the serum calcium level and incidence of preeclampsia at the time of the visit. Therefore, the findings are valid at the time of measurement. However, it is possible that some more pregnant women might have developed preeclampsia later on, which was not recorded. We had collected the serum for estimating the calcium level among pregnant women with 28-36 weeks of gestation. Other studies had estimated the serum calcium level at the time of delivery. It has been shown that serum calcium level decreases with increasing months of gestation.[21] Therefore, the serum calcium level would be lower at the time of delivery as compared to the level at 28-36 weeks of gestation. Therefore, a lower level of serum calcium and the occurrence of preeclampsia were concomitant and might not be etiologically associated.

There was no statistically significant association between dietary calcium intake and preeclampsia. It is hypothesized that low calcium intake may cause high blood pressure by stimulating the release of parathyroid hormone and/or renin, thereby increasing intracellular calcium concentration in vascular smooth muscle cells and causing vasoconstriction.[25] A possible explanation for the mode of action of calcium supplementation is that it reduces parathyroid calcium release and intracellular calcium concentration, thereby reducing smooth muscle contractility and promoting vasodilatation.[26] But all these effects are exerted by the serum calcium level, which we have shown is independent of the dietary calcium intake. Thus, calcium supplementation is unlikely to have an effect on the incidence of preeclampsia.

CONCLUSIONS:

The dietary calcium intake only replenishes the stores and the serum calcium levels are maintained in a tight range. Knowledge regarding calcium intake and serum calcium level in community settings can help us better frame the policies and guidelines regarding calcium supplementation.

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