Original Research Article

Evaluation of correlation-ship of serum calcium levels in pregnant women from tertiary hospital- An institutional study

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Abstract

Background: The complication arises during pregnancy has been shown to be associated with low serum calcium level. Though the evidence is abundant, it is equivocal. Objectives: To estimate the prevalence of hypocalcaemia among pregnant women and to document the association between serum calcium and pregnancy outcomes **Materials and Methods:** A hospital-based cross-sectional study was conducted in the Department of Obstetrics and Gynaecology, Kamineni institute of medical sciences, Telangana. All pregnant women between 28 weeks and 36 weeks of gestation were interviewed. A semi-structured interview schedule and a 24-h dietary recall questionnaire were administered to assess the dietary calcium intake. Autoanalyser was used for measuring serum calcium. **Results:** We enrolled 100 pregnant women. The mean age (SD) of the pregnant women was 29.4 ± 2.9 years ranged from 19 to 42 years with anaemia (31%) and Pre-eclampsia was 57%. The mean serum calcium level (SD) was 7.98 ± 2.21 mg/dL. 56 participants were suffering from hypocalcaemia and 61 participants' hypomagnesaemia. The correlation between the serum calcium and birth weight showed significant (P<0.5) relation. **Conclusion:** The majority of pregnant women had inadequate dietary calcium intake. The prevalence of hypocalcemia was high. Low serum calcium level was associated with complications of pregnancy. Calcium supplementation may reduce chances of complications in this population.

Keywords: Serum calcium, pregnancy, Pre-eclampsia, low birth weight.

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INTRODUCTION

Pregnancy is a period of increasing metabolic demands compounded by requirements of a growing foetus. It is also noted that, a number of physiological changes take place in the mother which includes cardiovascular and renal function changes to accommodate the changing needs of the mother and the foetus; several reasons play an important role for the above changes.[1] There is increasing evidence about the association of hypocalcaemia in pregnancy leading to several life-threatening morbidities. Maternal hypocalcaemia has been associated with high blood pressure, pregnancy induced hypertension,[2] pre-eclampsia and increased serum lead levels.[3] Calcium requirement in non-pregnant state is 600 mg/day which increases to 1,200 mg/day during pregnancy is recommended by WHO and the Food and Agriculture Organization of the United Nations.[4] This increased amount of calcium is required for the growth and development of bones and teeth of foetus. So the requirement of calcium in pregnancy is very high and if unmet leads to foetal morbidities like neonatal low bone mass, poor foetal growth and increased risk of small for gestational age.[5] Calcium supplementation during pregnancy for women with deficient dietary calcium intake is associated with significant benefits for individual women.

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Preeclampsia is one of the common complications associated with maternal hypocalcaemia during pregnancy. Previous studies have reported that preeclamptic women have lower serum calcium level as compared to normal pregnant women.[6] Many factors have been implicated in the pathogenesis and pathophysiology of preeclampsia which may vary according to the different population characteristics and several other factors can be influenced by diet, exposure to sunlight, and bone mass density, amongst other factors.[7] Thus the need to determine the relationship between serum calcium levels and pre-eclampsia in our environment is imperative, as a rational basis for formulating effective intervention in our locality. To the best of our knowledge, multiple studies have been conducted in the developed world to describe serum calcium disorders in pregnancy but these studies are however sparse in our setting. The burden of hypocalcaemia in late pregnancy; period during which foetal demands are maximum has not been studied much. Therefore, the study aimed to estimate the prevalence of hypocalcaemia among pregnant women and to document the association between serum calcium and pregnancy outcomes

METHODS

Study design and participants: The study was a cross-sectional study included 100 pregnant women between 28 weeks and 36 weeks of gestation were interviewed at Department of Obstetrics and Gynecology, Kamineni Institute of Medical Sciences Narketpally, Telangana. Study subjects were included after detailed explanation about the study and obtaining written informed consent and Ethical Committee approval was also obtained before starting of the study.

All the pregnant women included in the study were followed until birth of the baby for final maternal and perinatal outcomes, which were recorded.

Data collection: A detailed history on socio-demographic details, obstetric history, and antenatal history was collected. A semi-structured interview schedule and a 24-h dietary recall questionnaire were administered to assess the dietary calcium intake. Pregnant women with essential hypertension, asthma, hematological disorders, cardiac disease, liver and kidney disease excluded from our study

Specimen: Blood sample (random) was taken from each pregnant woman, serum sample was obtained by centrifugation of blood samples at 2000rpm for 10min, and it was stored at −20° until the date of analysis. The serum calcium levels and other blood biochemical parameters evaluation were determined by spectrophotometric method by using Biochemistry Fully Automated Analyser.

Statistical analysis: Data analysis was done by using SPSS Package version. Simple proportions, mean, standard deviation and Student "t" test and Chi-square test was used to find out the association between two groups. P value < 0.05 is considered as statistically significant.

RESULTS

A total of 100 pregnant women were enrolled in the study. The mean age (SD) of the pregnant women was 29.4 ± 2.9 years ranged from 19 to 42 years. Almost three-fourth of women was in the age group 19-29 years. More than 52% of women were working. Obstetric profiles of pregnant women around 57% of the women were having primigravida, and 6% were grand-multigravida. Significant proportion of pregnant women had anaemia (31%) and Pre-eclampsia was 57% (Table 1).

Table 1: Distribution of pregnant women by socio-demographic and clinical variables (n=100)

	Categories	Number
Age group (in years)	19 - 24	47
	25 – 29	29
	29 – 34	14
	>=35	10
Occupational status	Professionals	52
	Home maker	47
Educational status	Intermediate and above	29
	High school	64
	Primary	7
Gravidarum	1	52
	2	26
	3	16
	>=4	6
Presence of high-risk factors	Pre-eclampsia	57
	Severe anaemia	31

A total of 51 pregnant women had dietary calcium intake more than or equal to the recommended value (RDA = 1,200 mg). However, 39 pregnant women had serum calcium level of more than 9 mg/dL. The mean serum calcium level (SD) was 7.98 ± 2.21 mg/dL against the normal level of 8.6-10.3 mg/dL (Table 2).

Table 2: Biochemical parameters evaluation of pregnant women population.

Parameter	Levels
Serum Calcium (mg/dL)	7.98 ± 2.21
Serum Phosphorus (mg/dL)	4.45 ± 0.12
Serum Albumin (g/dL)	3.97 ± 0.12
Serum Alkaline Phosphotase (IU/L)	314.80 ± 13.12
25 (OH)Vitamin-D (ng/mL)	22.28 ± 0.95
Elevated Alkaline Phosphotase	93.3%
Hypovitaminosis D	56.6%

In our present study out of 100 pregnant women 56 participants were suffering from hypocalcaemia and 61 participants' hypomagnesaemia. Altogether 52 participants observed with both hypocalcaemia and hypomagnesaemia. The maximum percentage (72) of the study participants has BMI >25. The only 11% women had dietary calcium intake more than the recommended amount of 1200 mg/day (Table 3).

Table 3: Evaluation of correlation ship of BMI, Calcium and Magnesium levels among pregnant women population

Variables		Number of Participants
BMI (kg/m²)	BMI >20	19
	BMI <25	72
	Obese ≥27	9
Ca^{2+} (mg/dL)	Low (<8.5mg/dL)	56
	Normal (8.6-10.3 mg/dL)	44
Mg^{2+} (mg/dL)	Low (<1.6 mg/dL)	61
	Normal (1.7-2.2 mg/dL)	39
Dietary calcium intake (in mg/day)	<400	14
	>800	75
	>=1,200	11

The correlation between the serum calcium and birth weight showed significant (P<0.5) relation, total of 57 neonates of Pre-eclmapsia showed the mean birth weight was 2.36 ±0.47 Kg, whereas in other (without Pre-eclampsia) control group showed 3.31±0.375 Kg as shown in Table 4.

Table 4: Evaluation of correlation ship of maternal serum calcium levels and neonatal birth weight

Categories	Pre-eclampsia	Control
Serum Calcium (mg/dl)	7.98 ± 2.21	9.25 ± 0.58
Birth Weight (Kg)	2.36 ±0.47	3.31±0.375
P value	0.02	

DISCUSSION

The present study was planned to understand the association of serum calcium levels in related to pregnancy outcomes at a tertiary hospital. It is well documented that, serum calcium appears to play an important role in the development of preeclampsia and it can evolve as a sensitive test for early detection of this disorder. Role of calcium intake during pregnancy was studied by several authors,[8] a similar observation was made in the present study, where 11% of pregnant women have less intake of dietary calcium than the recommended daily allowance (RDA) of 1,200 mg/day for pregnant women. BMI in pregnant women results of the present study did not showed statistically significant association with low serum calcium levels compared to their counterparts with higher BMI. These results are in accordance with a study conducted on obesity and calcium absorption, resulted in metabolic status influences calcium absorption such that severe obesity is associated with higher calcium absorption.[9] The mean serum $Ca^{+2}$and Mg^{+2} level in the present study was lower in comparison to non preeclamptic. These findings were compatible with the study conducted by Jain group[10] their study showed a significant reduction in serum Ca^{+2} and Mg^{+2} levels throughout the course of pregnancy whether among preeclamptic or normal pregnant women. It has been evidenced that there is a progressive regression in the calcium, zinc and magnesium concentration in maternal serum during pregnancy.[11] Furthermore, less intake of certain micronutrients and increased metabolism may further decrease their serum levels. During preeclampsia, increased free radicals and decrease micronutrient levels may lead to oxidative stress.[12] Earlier studies have shown the level of serum calcium and serum magnesium was significantly lower in preeclamptic women than in normal healthy controls.[13] Hypocalcaemia in pregnancy as shown by our results, supported by existing findings in literature constitutes a serious and relatively very frequent disorder

in pregnancy where significantly reduced plasma calcium in preeclampsia than in the normal pregnancy.[3] Lack of calcium supplementation and the inability to meet calcium intake from locally available diets remain the most likely explanation for this high rate of hypocalcemia. Thus, serum calcium appears to play an important role in the development of preeclampsia and it can evolve as a sensitive test for early detection of this disorder. As the severity of pre-eclampsia increased, serum calcium levels were observed to gradually decrease, as measured by increased diastolic blood pressure and increased proteinuria.[14] We also explored the association of Vitamin D in the present study, it was observed that the 56% of the pregnant women has shown Hypovitaminosis D. Vitamin D supplementation to improve outcomes, including reducing the risk of pre-eclampsia, is under investigation. It was evident that, low vitamin D can lead to low calcium levels, which in turn can lead to increased vasoconstriction and hypertension by stimulating the release of PTH or renin, and calcium can be inversely proportional to preeclampsia.[15] In the present study a significant correlation was found between maternal serum calcium levels and severity of disease as well as maternal outcome. The correlation between the serum calcium and birth weight showed significant relation. This was supported by a recent meta-analysis which reported that women with hypocalcaemia during pregnancy were likely to have problems related pregnancy outcomes. Another meta-analysis concluded that calcium supplementation, though does not prevent preeclampsia but does reduce its severity, associated maternal and neonatal morbidity and mortality.[16] To conclude the present study, hypocalcaemia in pregnant women was significantly associated with pregnancy outcomes. Low birth weight was associated with low serum calcium levels. These results suggest the possible role of calcium in pregnant women. Further studies are necessitated to investigate the potential role of dietary supplementation of micronutrients during pregnancy.

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