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RESEARCH ARTICLE

To find association of Socio-Demographic factors of pregnant women with Hypocalcaemia

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Abstract

During pregnancy calcium demand increases due to increase requirement by the developing foetus. This demand is met by dietary calcium intake. Physiological changes in pregnancy tend to lower calcium and calcium homeostasis is maintained by various hormones. The present study was done to find association of sociodemographic factors of the pregnant women with hypocalcaemia.

Material and methods: 100 women in their third trimester of pregnancy were included in the study after obtaining written informed consent. After detail history and examination, 5 ml venous blood is collected to measure serum ionic calcium. Data were entered in to MS Excel sheet and analysed.

Results: Normal serum ionic calcium range is 4.2 – 5.5 mg%. Out of 100 women 36% women had hypocalcaemia. There was no significant association between hypocalcaemia and age (p=0.8), residence (p=0.6), religion (p=0.1), socio-economic status (p=0.8). There was significant association between hypocalcaemia and literacy status (p-0.02). Women with past history of preterm birth and abortion had more risk of having hypocalcaemia. There was a negative correlation between maternal age and mean serum ionic calcium level.

Conclusion: Hypocalcaemia is common in pregnancy. Hypocalcaemia was more common in women who were above 25 years of age, muslim, illiterate, belonging to lower and middle socio-economic status and multiparous. Risk of Hypocalcaemia was more in women with gestational age below 34 weeks. All women in their antenatal period should be screened for hypocalcaemia and calcium should be supplemented routinely to all women during antenatal period.

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Introduction

Pregnancy is a period of high calcium demands because of the foetal requirements, which is met by the dietary calcium intake. Various physiological changes that affect calcium metabolism are decrease in albumin levels, increase in extracellular fluid volume, increase in renal function and placental calcium transfer. These mechanisms all tend to promote lowering of maternal calcium concentration.[1]Calcium homeostasis is regulated by a complex mechanism coordinated by a variety of hormones - parathyroid hormone, calcitonin and 1,25-dihydroxyvitamin D 3 (1, 25(OH)2D). There is fall in total serum calcium during pregnancy because of hemodilution. However, constant blood levels of calcium are maintained by homeostatic control mechanism. These are increase in intestinal calcium absorption, increase in urinary excretion of calcium and increase bone turnover.[2,3,4]

In the circulation, calcium is distributed between three inter-convertible fractions. Approximately 50% of total serum calcium is in the ionised form at normal serum protein concentrations and it represents the biologically active component of the total serum calcium concentration. Another 8–10% is complexed to organic and inorganic acids (e.g. citrate, sulphate and phosphate); together, the ionised and complexed calcium fractions represent the diffusible portion of circulating calcium. Approximately 40% of serum calcium is protein-bound, primarily to albumin (80%) but also to globulins (20%). The protein-bound calcium is not biologically active but acts as a reserve of available calcium whenever a need for increased ionised calcium arises.[5]

Normal total serum calcium concentration ranges from 8.8 to 10.4 mg/dl (2.2 to 2.6 mmol/L) and serum ionic calcium ranges from 4.2 to 5.5 mg/dl (1.3-1.5 mmol/L) in healthy subjects.[6] This value however is usually subjected to significant variations depending on factors like parathyroid hormone and calcitonin secretion, dietary intake and other conditions like osteoporosis.[7] Recent literatures says that the serum levels of ionized calcium remain sensibly unperturbed during pregnancy[7-10] still Kumar A et al from India[11] and Benali AI, Demmouche A from Algeria[12] have reported a very high prevalence of hypocalcaemia in pregnancy (66.4% and 70.55% respectively). According to two recent systematic reviews, low and middle income countries are more likely to have significantly lower calcium intake compared to countries of the developed world.[13,14] Very few studies have been done in our state to find hypocalcaemia during pregnancy and its association with sociodemographic profile of the women so the present study was done to find association of sociodemographic factors of the pregnant women with hypocalcaemia.

Material and Methods

This was a hospital based cross-sectional study conducted in the Department of Obstetrics and Gynaecology, S.M.S. Medical College, Jaipur. 100 women in their third trimester of pregnancy and who were willing to participate in the study were included in the study after obtaining written informed consent. Women with chronic medical disorders, Intra-uterine foetal death and twin pregnancy were excluded from the study. After detail history and examination, 5 ml venous blood is collected to measure serum ionic calcium. Data were entered in to MS Excel sheet and analysed.

Results

A total of 100 pregnant women were included in the study after taking written informed consent. Socio-demographic and obstetric profile of the women is shown in Table 1. Mean age of the women was 26.01±3.65 years with the range of 19 – 35 years. Out of 100 women, majority (52%) were between 25 to 30 years, 29% women were between 20 to 25 years, 16% women were above 30 years and only 3 women were below 20 years. 61% women belonged to urban area, 71% women were Hindu, 51% were literate. 95% women belonged to lower and middle socio-economic status and only 5% women belonged to upper class of socio-economic status. 54% women had normal BMI. 39% women were primigravida. 28% women had gestational age below 34 weeks. Mean gestational age was 35.86±3.23 weeks.

Table 2 shows association between hypocalcaemia and maternal variables. Normal serum ionic calcium range is 4.2 – 5.5 mg%. Out of 100 women 36% women had hypocalcaemia. There was no significant association between hypocalcaemia and age (p=0.8), residence (p=0.6), religion (p=0.1), socio-economic status (p=0.8). there was significant association between hypocalcaemia and literacy status [OR 2.5; 95%CI (1.1125-6.0103;p-0.02].

Table 3 shows association between hypocalcaemia and maternal obstetrical variables. No significant association was found between gravidity and hypocalcaemia (p-0.2). Women with past history of preterm birth had 1.7 times more risk of having hypocalcaemia [OR 1.7; 95% CI (0.6076-5.0171); p=0.3]. Women with past history of abortion had 1.5 times risk of having hypocalcaemia [OR 1.5; 95% CI (0.3698-5.8831); p=0.5]. Women with gestational age below 34 weeks had 1.2 times risk of having hypocalcaemia [OR1.2;95% CI (0.4944-2.9931); p-0.6)

There was a weak negative correlation between maternal serum ionic calcium and age but the correlation was significant (R = -0.2032; p = 0.04) (Table 4 and graph 1)

There was a weak positive correlation between maternal gestational age and serum ionic calcium levels and the correlation was statistically significant (R =0.1998; p=0.04) (Table 5 and Graph 2)

Table 1: Socio-demographic and obstetric characteristics of the study population

Variables	Frequency	Percentage
Age groups (years)		
<20	3	3
20 – 25	29	29
25 – 30	52	52
≥30	16	16
Residence		
Urban	61	61
Rural	39	39
Religion		

Hindu	71	71
Muslim	29	29
Literacy Status		
Illiterate	49	49
Literate	51	51
Socio-economic status		
Lower	48	48
Middle	47	47
Upper	5	5
BMI (kg/m^2)		
<25	54	54
≥25	46	46
Gravida		
Gravida 1	39	39
Gravida 2	30	30
Gravida ≥3	31	31
Gestational age (weeks)		
<34	28	28
≥34	72	72

Table 2: Determination of the association between hypocalcaemia and maternal variables

Maternal Variables	**Hypocalcaemia**		**Inferential Statistics**	
	Yes (n=36) No (%)	**No (n=64) No(%)**	**OR [95% CI]**	**P – value**
Age				
<25 (n=32)	11 (34.4)	21 (65.6)	0.9 [0.3735 – 2.1731]	0.8
≥25 (n=68)	25 (36.8)	43 (63.2)		
Residence				
Urban (n=61)	23 (37.7)	38 (62.3)	1.2 [0.5208 – 2.8137]	0.6
Rural (n=39)	13 (33.3)	26 (66.7)		
Religion				
Hindu (n=71)	22 (30.9)	49 (69.1)	0.4 [0.1985 – 1.1658]	0.1
Muslim (n=29)	14 (48.3)	15 (51.7)		
Literacy Status				
Illiterate (n=49)	23 (46.9)	26 (53.1)	2.5 [1.1125 – 6.0103]	0.02
Literate (n=51)	13 (25.5)	38 (74.5)		
S E Status				
Lower (n=48)	17 (35.4)	31 (64.6)	0.8 [0.1250 – 5.4149]	0.8
Middle (n=47)	17 (36.2)	30 (63.8)	0.8 [0.1290 – 5.6016]	0.8
Upper (n=5)	2 (40)	3 (60)	1	
BMI (kg/m^2)				
<25 (n=54)	27 (48.1)	27 (51.9)	4.1[1.6666 – 10.1411]	0.002
≥25 (n=46)	9 (21.7)	37 (78.3)		
SBP less than 130 mm of Hg				
yes (n=44)	11 (25.0)	33 (75.0)	0.28 [0.1221 – 0.6834]	0.004

No (n=56)	30 (53.6)	26 (46.4)		
DBP less than 90 mm of Hg				
yes (n=50)	10 (20.0)	40 (80.0)	0.16 [0.0681 – 0.4077]	0.0001
No (n=50)	30 (60.0)	20 (40.0)		

Table 3: Determination of the association between hypocalcaemia and maternal obstetrical variables

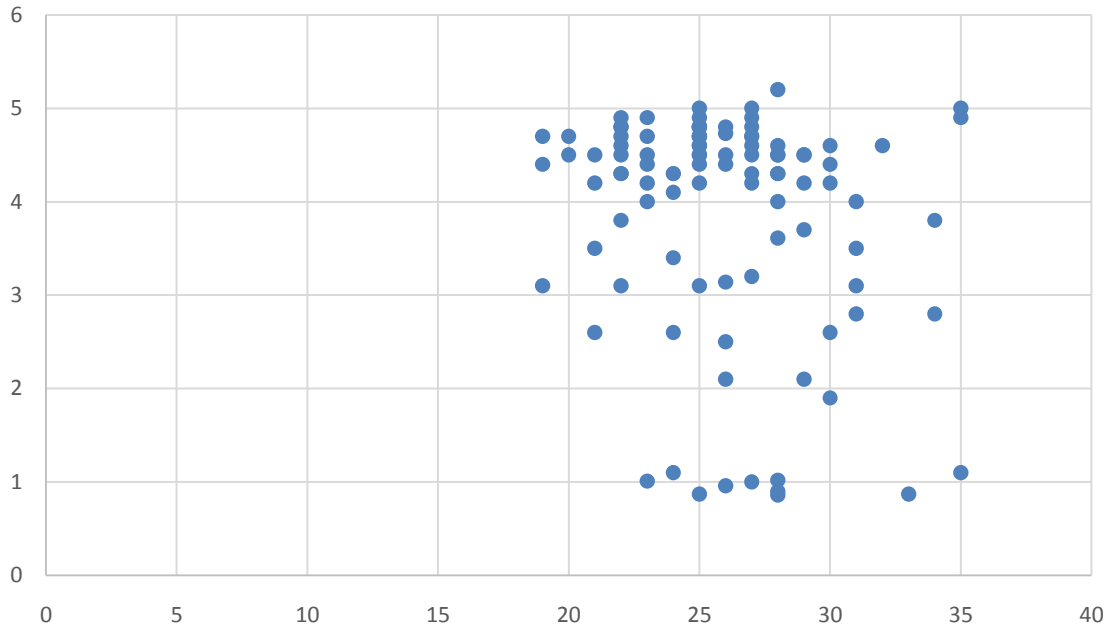
Maternal Obstetrical variables	Hypocalcaemia		Inferential Statistics	
	Yes (n=36) No. (%)	No (n=64) No. (%)	OR [95% CI]	P - value
Parity				
Para 0 (n=46)	18 (39.1)	28 (60.9)	1	
Para 1 (n=31)	8 (25.8)	23 (74.2)	0.5 [0.1993 – 1.4692]	0.2
Para ≥2 (n=23)	10 (43.5)	13 (56.5)	1.2 [0.4336 – 3.3019]	0.7
Past preterm birth				
Yes (n=17)	8 (47.1)	9 (52.9)	1.7 [0.6076 – 5.0171]	0.3
No (n=83)	28 (33.7)	55 (66.3)		
Past abortion				
Yes (n=9)	4 (44.4)	5 (55.6)	1.5 [0.3698 – 5.8831]	0.5
No (n=91)	32 (35.2)	59 (64.8)		
Gestational Age				
<34 (n=28)	11 (39.3)	17 (60.7)	1.2 [0.4944 – 2.9931]	0.6
≥34 (n=72)	25 ((34.7)	47 (65.3)		

Table 4: Pearson Correlation between S. Calcium and age of the women

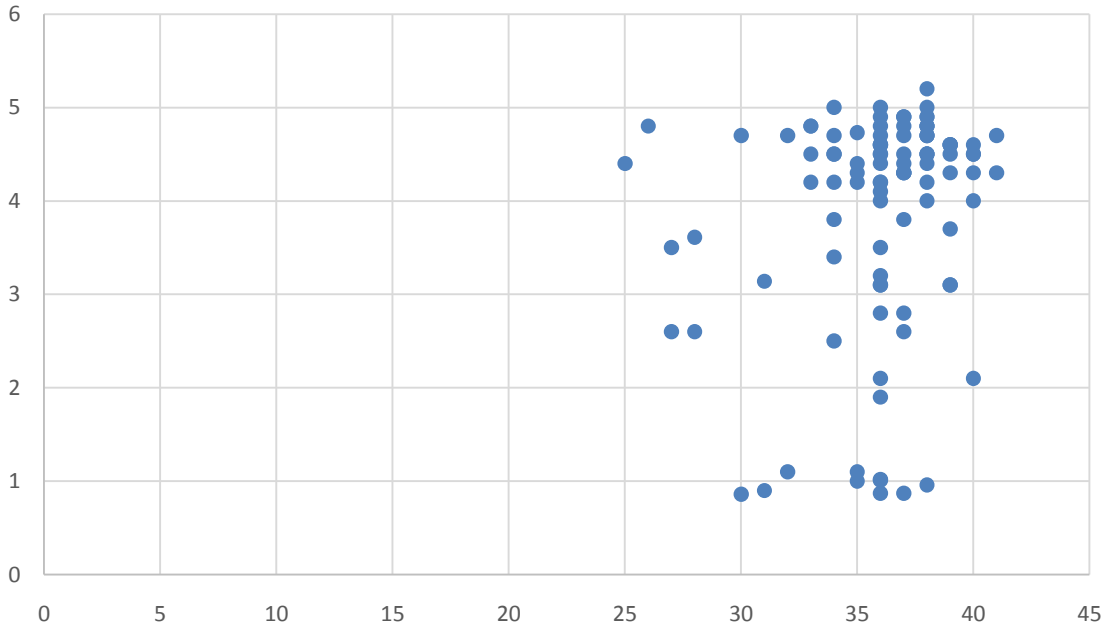
N = 100	Mean ± SD	R	R Square	Equation	P value
Age	26.01±3.65				
S. Calcium	3.85±1.21	-0.2032	0.0413	Y = -0.06716*X + 5.602	0.04

Table 5: Pearson Correlation between S. Calcium and gestational age of the women

N = 100	Mean ± SD	R	R Square	Equation	P value
Gestational Age (Weeks)	35.86±3.23				
S. Calcium	3.85±1.21	0.1998	0.0399	Y = 0.07450*X + 1.183	0.04



Graph 1: Correlation between Age of the women and serum ionic calcium (X axis: Age in years; Y axis: S. ionic calcium mg/dl)



Graph 2: Correlation between gestational age and serum ionic calcium (X axis: Gestational age (weeks); Y axis: Serum ionic calcium (mg/dl))

Discussion

Mean age of the women in our study was 26.01±3.65 years which was comparable with mean age observed by Rajendra Kumar Chaudhari et al[15], and Roy HL et al[16]. Mean age of the women in our study was more than the mean age observed by Golmohammadlou et al[17], Pairu J et al[18] and slightly lower than mean age observed by Ajong AB et al[19], Deepa V Kanagal et al[20]. 71 % in our study were Hindu while in a study done by Thangappah RBP et al, 92% women were Hindu[21]. In our study 51% women were literate while in the study done by Ajong AB et al[19] literacy rate was 100%. 95% women in our study belonged to lower and middle socio-economic status. 54% women had normal BMI which was comparable with the observation made by Thangappah RBP et al[21] in their study. In our study 39% women were primigravida while in the studies done by Thangappah RBP et al[21] and Ajong AB et al[19] 32% and 25.71% women were primigravida respectively. Mean gravidity in our study was 1.92±0.84 which was lower than mean gravidity observed by Ajong Ab et al[19] and Kocyłowski et al[22]. Mean gestational age in our study (35.86±3.23 weeks) was lower than mean gestational age (38.96±1.93 weeks) observed by Ajong AB et al[19]and Kocyłowski et al[22]but higher than mean gestational age observed by Akhtar et al[23] and Roy HL et al[16].

In our study hypocalcaemia was seen in 36% of women in their third trimester which was much lower than the prevalence observed by various studies done in the past.[11,12,24]Bako B et al[25] in their study observed hypocalcemia in 29.2% pregnant women. The difference in prevalence in different studies may be due difference in population chracteristics, methodology or nutritional differences between different population.

On simple logistic regression there was no significant association of age, residence, religion and socio-economic status with hypocalcemia (p- 0.8,0.6,0.1 and 0.8 respectively). Illiteracy has two and half times risk of having hypocalcemia and the association was significant (p-0.02). Women with BMI <25 kg/m2 were 4.1 times more likely to have e low serum calcium levels compared to their counterparts with higher BMI and the association was statistically significant. (4.1 [1.6666 – 10.1411]; p -0.002). Ajong AB et al[19] in their study found no statistically significant association between BMI and hypocalcemia (p value-0.178). According to a study done by Cifuentes M et al[26]they observed that severe obesity is associated with higher calcium absorption. Dalfard O et al[27] in their study observed that serum calcium had a significant direct correlation with BMI. Obesity induces an increase in pro-inflammatory cytokines[28,29] which leads to osteoclasts activity and bone resorption[30]; subsequently serum calcium level in obese people is higher.

Systolic blood pressure and serum calcium showed an inverse association. Pregnant women with systolic blood pressure below 130 mm of Hg were less likely to have hypocalcaemia than women with systolic blood pressure more than 130 mm of Hg. (OR-0.28 [0.1221 – 0.6834]). The association between systolic blood pressure and hypocalcaemia was statistically significant (p-0.004). Our results were consistent with results observed by Ajong AB et al[19] in their study. Pregnant women with diastolic blood pressure below 90 mm of Hg were less likely to have hypocalcaemia than women with diastolic blood pressure more than 90 mm of Hg. (0.16 [0.0681 – 0.4077]). The association between diastolic blood pressure and hypocalcaemia was statistically significant (p-0.0001). Decrease in serum calcium levels led to an increase in intracellular calcium. This led to constriction of smooth muscles in blood vessels and increased vascular resistance[31,32]culminating in a raised systolic and diastolic blood pressure. Low serum calcium levels may also increase blood pressure by stimulating parathyroid hormone and renin release, which in turn increases intracellular calcium in smooth muscles, leading to vasoconstriction,

increased vascular resistance and a rise in blood pressure in pre-eclamptic mother.[29,30] The protective effect of calcium on blood pressure can be explained by the influence of calcitrophic hormones on intracellular calcium.

25.8% women with first pregnancy had hypocalcemia while 43.5% women with para 2 and above had hypocalcemia. Prevalence of hypocalcemia in relation with parity was lower in our study than prevalence of hypocalcemia observed by Ajong AB et al[19]. Women with past history of preterm delivery and abortion had 1.7 and 1.5 times respective risk of hypocalcemia. Women with gestational age less than 34 weeks had 1.2 times risk of hypocalcemia. It is believed that low serum calcium during pregnancy stimulates PTH secretion thereby increase in intracellular calcium and smooth muscle contractility as well as increase uterine smooth muscle contractility and increase risk of preterm labour and delivery.[4]

There was a negative correlation between maternal age and mean serum ionic calcium level. Our results were in agreement with results of Kocyłowski et al[22].

Conclusion

Hypocalcaemia is common in pregnancy. Hypocalcaemia was more common in women who were above 25 years of age, muslim, illiterate, belonging to lower and middle socio-economic status and multiparous. Risk of hypocalcaemia was more in women with gestational age below 34 weeks. All women in their antenatal period should be screened for hypocalcaemia and calcium should be supplemented routinely to all women during antenatal period.

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