

Comparison of Serum Vitamin D and Serum Calcium Level in Cases with Pre-Eclampsia, Eclampsia and Healthy Pregnant Woman in Tertiary Level Hospital

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ABSTRACT

Background: Vitamin D deficiency is associated with physiologic changes that are similar to pathogenesis of preeclampsia.

Objectives: The aim of the study was to comparison of serum vitamin D and serum calcium level in cases with pre-eclampsia, eclampsia and healthy pregnant woman in Tertiary Level Hospital.

Methods: This cross-sectional study was carried out in the department of Obstetrics & Gynaecology, Dhaka Medical College, Dhaka during the period of January 2017 to December 2017. A total number of 90 woman after 20 weeks of gestation were enrolled in this study and they were classified as Preeclamptic pregnant women (n=30), Eclamptic pregnant women (n=30) and healthy pregnant women (n=30). Serum vitamin D and serum calcium level were assessed for among three groups. Statistical analyses of the results were be obtained by using window-based Microsoft Excel and Statistical Packages for Social Sciences (SPSS-24).

Results: Most (95.5%) patient had vitamin-D <20 ng/ml in group A, 27(90.0%) in group B and 3(9.1%) in group C. The mean vitamin-D was 8.99+4.27 ng/ml in group A, 10.89+4.91 ng/ml in group B and 22.66±8.01 ng/ml in group C. The different was statistically significant (p<0.05) among the three groups. The mean calcium level was 7.77+0.52 mg/dL in group A, 8.140.6 mg/dL in group B and 8.8+0.36 mg/dL in group C. The different was statistically significant (p<0.05) among the three groups.

Conclusion: This study suggested that vitamin D plays a role in the etiology and pathophysiology of preeclampsia & eclampsia as well as serum calcium may have a role in the etiopathogenesis of this disorder.

Keywords: Pre-eclampsia, Eclampsia, Normal Pregnancy, Hypovitaminosis D, Hypocalcemia

I. INTRODUCTION

Pre-eclampsia, defined by hypertension and proteinuria occurring after 20 weeks of gestation, is a multifactorial disorder that is associated with maternal and perinatal morbidity and mortality worldwide, its prevalence is 2-10% of all pregnancies and this may be higher in low resource settings. In our country it contributes to 20.0% of maternal death. [1-3]

The pathophysiological mechanism of preeclampsia in pregnancy is characterized by failure of the trophoblastic invasion of the spiral arteries, leading to maladaptation of maternal spiral arterioles, which may be associated with an increased vascular resistance of the uterine artery and a decreased perfusion of the placenta. [4] Some studies have shown that changes in the levels of blood trace elements in preeclamptic patients may implicate in its pathogenesis while others have failed to show an association of blood levels of trace elements and prevalence of preeclampsia. [5]

Calcium plays an important role in muscle contraction and regulation of water balance in cells. Decreased serum calcium could increase the parathyroid hormone levels that can cause shift of calcium intracellularly and increase vascular smooth muscle contraction. [6] Low serum calcium level can also cause 1, 25-dihydroxy cholecalciferol response, eventually increasing the BP. [7] Low calcium can increase blood pressure by releasing parathyroid hormone and renin. It is also seen that increased calcium excretion through urine is associated with higher blood pressure.

Calcium is an important component in balanced diet. During full-term pregnancy, the fetus takes approximately 30g from the mother's calcium, at the expense of the mother's bones if calcium intake is insufficient. In addition, women who consume more calcium during pregnancy may have higher levels of calcium in their breast milk and babies born to women with higher calcium intake may have better bone mineralization and lower blood pressure in later life. [8]

Earlier studies have shown that maternal vitamin D and calcium deficiency during pregnancy may be an independent risk factor for pre-eclampsia. Recent evidence suggested that combined vitamin D and calcium intake may be associated with better metabolic health. [9] There are several studies that have shown a positive association of vitamin D deficiency with preeclampsia whilst other study shown no association. [10] Most studies have reported the role of vitamin D and calcium in the pathophysiology of preeclampsia based on measurement of 25(OH) D without concurrent measurement of calcium. Our study aimed to investigate the serum vitamin D levels and calcium levels in eclampsia, preeclampsia and healthy pregnant women and to compare these between three groups.

II. METHODOLOGY

This cross-sectional study was carried out in the Department of Obstetrics & Gynaecology, Dhaka Medical College and Hospital, Dhaka, during January 2017 to December 2017. A total of 90 patients were participated in the study. Normal pregnant women and pregnant women with pre-eclampsia and eclampsia after 20 weeks of gestation was taken for the study, who attended in the Department of Obstetrics and Gynaecology in DMCH. After taking consent and matching eligibility criteria, data were collected from patients on variables of interest using the predesigned structured questionnaire by interview, observation. Statistical analyses of the results were be obtained by using window-based Microsoft Excel and Statistical Packages for Social Sciences (SPSS-24).

III. RESULTS

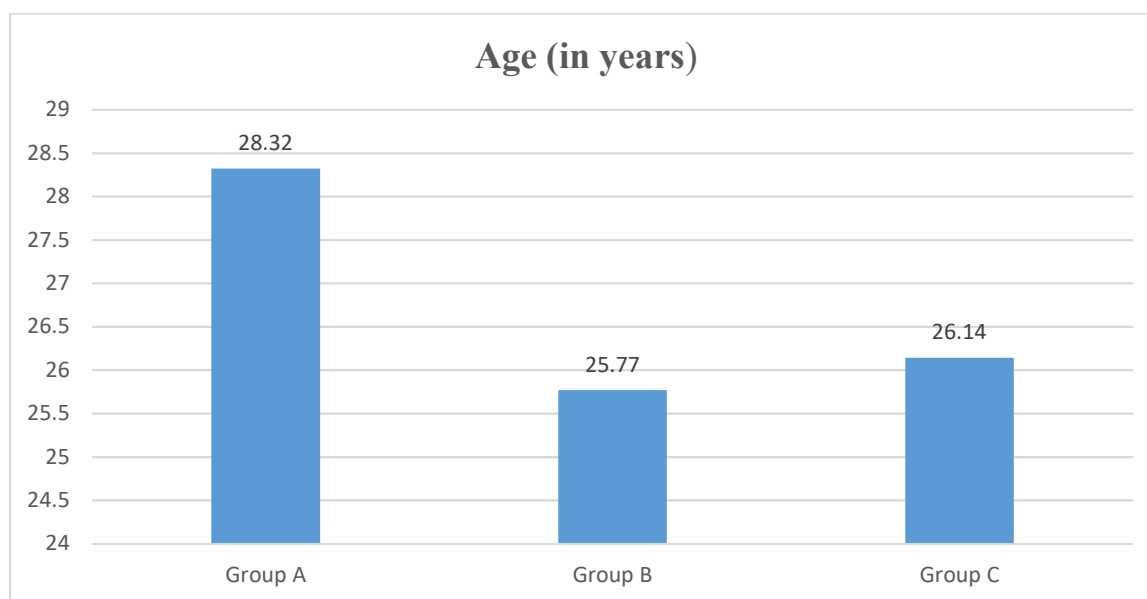


Figure I: Bar diagram shows mean age of the study patients

Figure I show the bar diagram shows mean age of the study patients. Here, the mean age was 28.32 ± 4.74 years in group A, 25.77 ± 4.88 years in group B and 26.14 ± 5.28 years in group C.

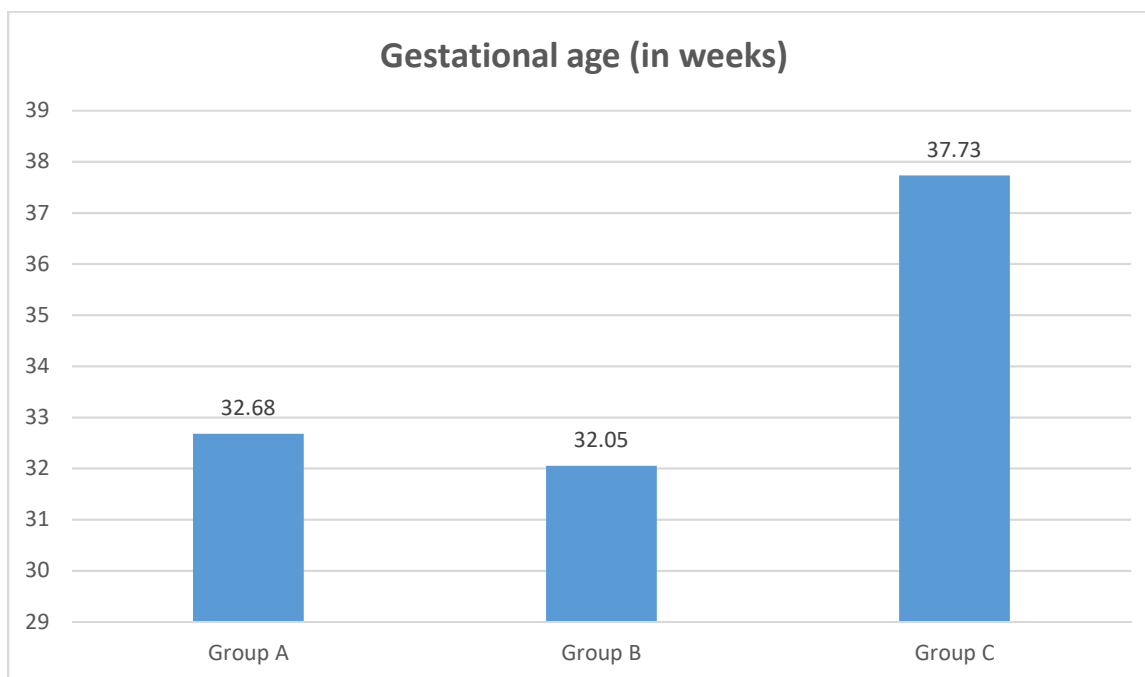


Figure II: Bar diagram shows mean gestational age of the study patients

Figure II show the bar diagram shows mean gestational age of the study patients. Here, the mean gestational age was found 32.68 ± 2.5 weeks in group A, 32.05 ± 1.69 weeks in group B and 37.73 ± 0.98 weeks in group C. The gestational age was statistically significant ($p < 0.05$) among the three groups.

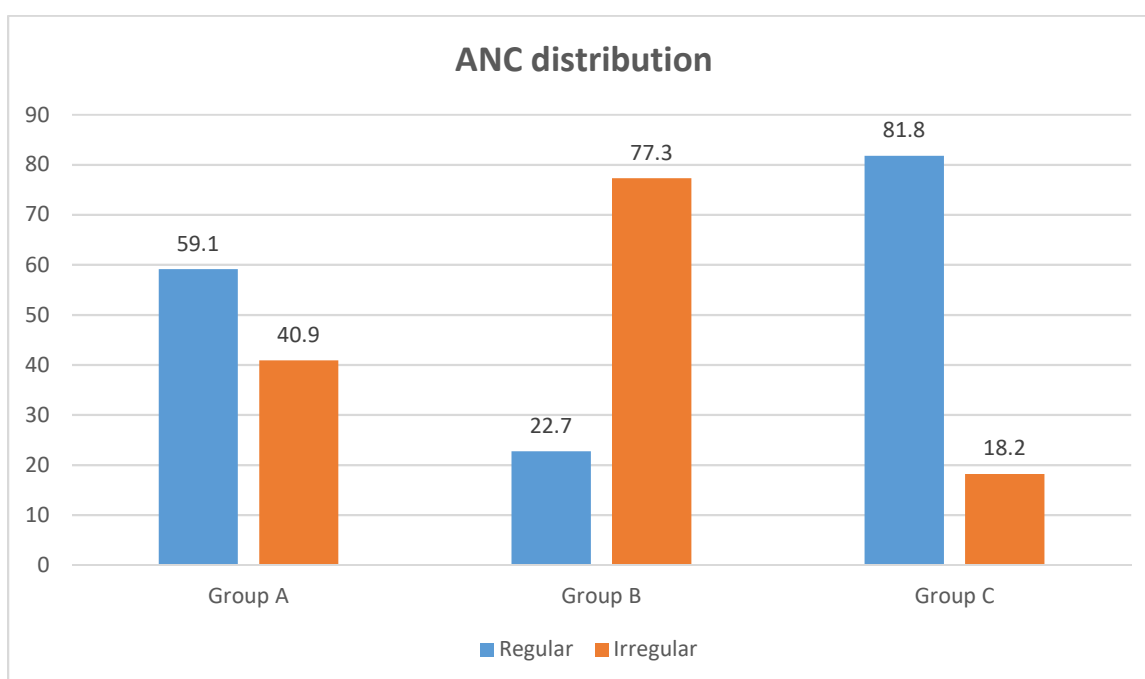


Figure III: Bar diagram shows ANC distribution of the study patients

Figure III show the bar diagram shows ANC distribution of the study patients. Almost two third (59.1%) patients had regular ANC in group A, 7(22.7%) in group B and 25(81.8%) in group C. The ANC was statistically significant ($p < 0.05$) among the three groups.

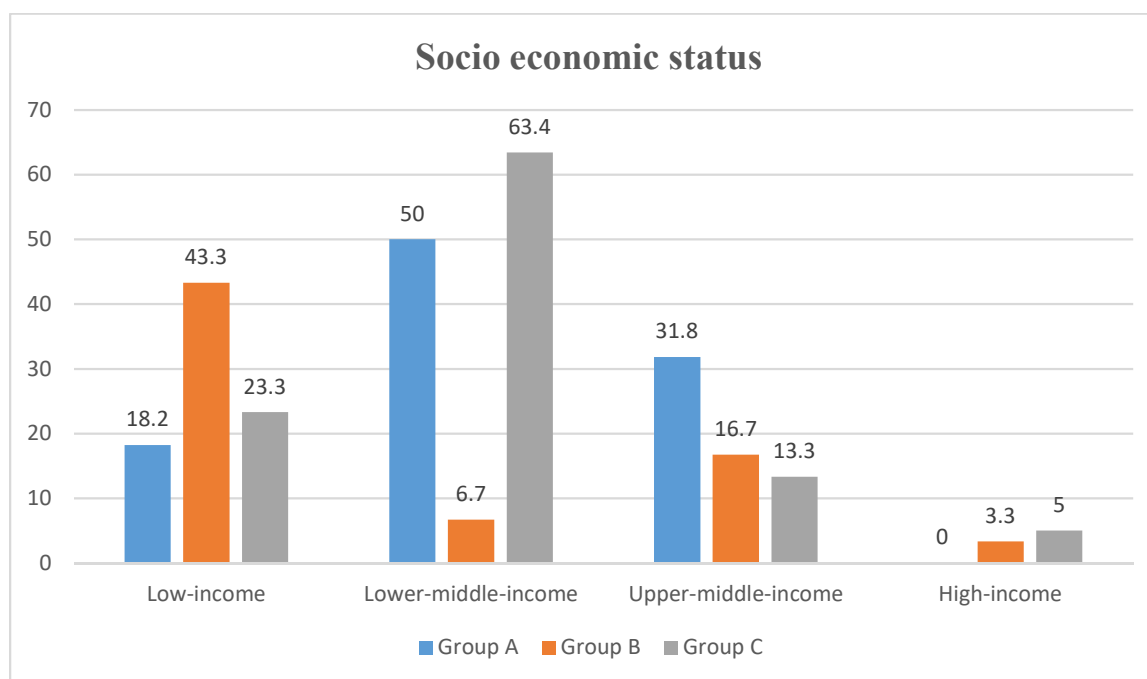


Figure IV: Bar diagram shows Socio economic status of the study patients

Figure IV show the Bar diagram shows Socio economic status of the study patients. Half (50.0%) of the patients were from lower middle-class family in group A, 11(36.7%) in group B and 19(63.4%) in group C. The difference was statistically not significant ($p>0.005$) among the three groups.

Table I: Distribution of the study patients according to clinical variables (n-90)

	Group A (n=30)		Group B (n=30)		Group C (n=30)		P value
	n	%	n	%	n	%	
Systolic blood pressure							
Mean±SD	171.8±24.2		159.5±21.49		111.82±10.53		^a 0.001 ^s
Range (max-min)	140-230		120-220		90-130		
Diastolic blood pressure							
Mean±SD	115.68±13.3		122.55±16.18		69.45±16.24		^a 0.001 ^s
Range (max-min)	90-150		90-140		8-90		
Severe oedema	19	63.6	11	36.4	0	0.0	^b 0.001 ^s
Massive albuminuria	14	45.5	20	68.2	0	0.0	^b 0.001 ^s

Table I shows systolic and diastolic blood pressure of the study patients, it was observed that majority (93.3%) patients had systolic blood pressure 140-230 mmHg in group A and 17(56.7%) in group B and none in group C. The mean systolic blood pressure (mmHg) was 171.82±24.62 in group A, 159.5±21.49 in group B and 111.82±10.53 in group C. The mean diastolic blood pressure (mmHg) was 115.68±13.3 in group A, 122.55±16.18 in group B and 69.45±16.24 in group C. Almost two third (63.3%) patients had severe oedema in group A and 11(36.7%) in group B, 14(45.5%) patients had massive albuminuria in group A and 20(66.7%) in group B. The difference statistically significant ($p<0.05$) among the three groups.

Table II: Distribution of the study patients according to vitamin-D level (n-90)

Vitamin D	Group A (n=30)		Group A (n=30)		Group A (n=30)		P value
	n	%	n	%	n	%	
<20 ng/ml	21	95.5	27	90.0	3	9.1	*0.001 ^s
≥20 ng/ml	1	4.5	3	10.0	27	90.9	
Mean±SD	8.99±4.27		10.89±4.91		22.66±8.01		
Range (max-min)	3.9-22.6		2.1-22.6		5.1-26.9		

Table II shows vitamin-D of the study patients, it was observed that majority (95.5%) patient had <20 ng/ml in group A, 27(90.0%) in group B and 3(9.1%) in group C. The mean vitamin-D was 8.99±4.27 ng/ml in group A, 10.89±4.91 ng/ml in group B and 22.66±8.01 ng/ml in group C. The different was statistically significant (p<0.05) among the three groups.

Table III: Distribution of the study patients according to serum calcium level (n-90)

Calcium level	Group A (n=30)		Group A (n=30)		Group A (n=30)		P value
	n	%	n	%	n	%	
≤8.5	20	68.2	16	54.5	4	13.3	*0.001 ^s
>8.5	10	31.8	14	45.5	26	86.7	
Mean±SD	7.77±0.52		8.14±0.6		8.8±0.36		
Range (max-min)	6.67-8.72		7.12-9.48		8.12-9.55		

Table III shows calcium level of the study patients, it was observed that more than two third (68.2%) patients had serum calcium level <8.5 mg/dL in group A, 16(54.5%) in group B and 4(13.3%) in group C. The mean calcium level was 7.77±0.52 mg/dL in group A, 8.14±0.6 mg/dL in group B and 8.8±0.36 mg/dL in group C. The different was statistically significant (p<0.05) among the three groups.

Table IV: Comparison of patients according to status of both the levels of serum calcium and vitamin D.

	Group A (n=30)		Group B (n=30)		Group C (n=30)	
	n	%	n	%	n	%
Normal Serum calcium (≥8.5mg/dL) and normal vitamin D (≥20ng/ml)	2	6.7	2	6.7	11	36.7
Normal serum calcium (≥8.5mg/dL) and low vitamin D (<20ng/ml)	8	26.7	11	36.7	19	63.3
Low serum calcium (<8.5mg/dL) and low vitamin D levels (<20ng/ml)	20	66.7	17	56.7	0	0.0

Table IV shows Comparison of patients according to status of both the levels of serum calcium and vitamin D, it was observed that more than two third (66.7%) patients had low serum calcium (<8.5mg/dL) and low vitamin D levels (20ng/ml) in group A. 17(56.7%) in group B and none in group C.

IV. DISCUSSION

Calcium is an important component in balanced diet. It is essential for the normal growth and maintenance of bones and teeth, and calcium requirements must be met throughout life. [11] Recent epidemiological studies have emphasized the role of vitamin D deficiency in the development of preeclampsia. [12] The role of vitamin D deficiency in immunomodulation and placental development has been emphasized in various studies and thus, they put the emphasis on vitamin D deficiency, regarding its possible role in the pathophysiology of preeclampsia. [13]

Adequate Vitamin D level is important not only for bone and calcium metabolism but also for maintenance of other systems. Vitamin D deficiency (VDD) during pregnancy have shown to be associated with many maternal and fetal complications thus increasing morbidity in mother, infant and child. [14] This cross sectional study was carried out with an aim to assess the serum vitamin D level, calcium level in cases with pre-eclampsia, eclampsia and healthy pregnant woman and to compare the serum vitamin D and serum calcium level in these three groups of pregnant women.

In this present study, it was observed that the mean age was 28.32 ± 4.74 years in group A, 25.77 ± 4.88 in group B and 26.14 ± 5.28 in group C. The differences were statistically not significant ($p > 0.05$) among three groups. Similarly, Aghade and Bavikar, showed the mean age was 24.40 ± 3.8 years in mild preeclampsia, 25.0 ± 4.3 years in severe preeclampsia and 25.50 ± 2.9 years in controls. [15] In another study Bakacak et al. (2015) found the mean age was 29.2 ± 8.40 in preeclampsia and 29.1 ± 8.47 in eclampsia and 28.9 ± 5.80 in healthy pregnant. [16] The difference was statistically not significant ($p > 0.05$). which is comparable with the current study. Again, this observation indicates that there may be some unique genetic or environmental factors responsible for the disease in our country.

Preeclampsia usually occurs in the 3rd trimester of pregnancy, but it can develop after the infant is delivered too. In this present study, it was observed that the participant was in 31.68 ± 2.5 weeks in group A, 32.05 ± 7.69 weeks in group B and 37.73 ± 0.98 weeks in group C. The mean gestational age difference was statistically significant ($p < 0.05$) three groups. Aghade and Bavikar (2017) showed the mean gestational age was 32.71 ± 4.30 weeks in mild preeclampsia, 33.15 ± 4.09 weeks in severe preeclampsia and 31.69 ± 5.28 weeks in controls. [6]

In this present study, it was observed that 93.3% patients had systolic blood pressure 140-230 mmHg in group A and 56.7% in group B and none in group C. The mean systolic blood pressure was 171.8 ± 24.62 mmHg in group A, 159.5 ± 21.49 mmHg in group B and 111.82 ± 10.53 mmHg in group C. The difference was statistically significant ($p < 0.05$) among three groups. Aghade and Bavikar, mentioned in their study that the systolic and diastolic blood pressures were significantly increased ($p < 0.05$) in preeclamptic patients compared with normal pregnant women, where they found the mean systolic blood pressure was 108.13 ± 6.35 mmHg in controls, 148.62 ± 7.2 mmHg in mild preeclampsia and 172.69 ± 11.6 mmHg in severe preeclampsia. [6] Similar observations also observed by Bakacak et al. (2015). [16]

In this current study, it was observed that the mean diastolic blood pressure was 115.68 ± 13.3 mmHg in group A, 122.55 ± 16.18 mmHg group B and 69.45 ± 16.24 mmHg in group C. The difference was statistically significant ($p < 0.05$) among three groups. Similarly, Bakacak found the mean diastolic blood pressure was 68.9 ± 8.77 mmHg in healthy pregnant, 105.7 ± 6.62 mmHg in preeclampsia and 106.8 ± 8.13 mmHg in eclampsia. [16] The difference was statistically significant ($p < 0.05$). Similar observations regarding the diastolic blood pressure also observed by Aghade and Bavikar. [6]

In this present study, it was observed that 95.5% patient had < 20 ng/ml vitamin D in group A, 90.0% in group B and 9.1% in group C. The mean vitamin D was 8.99 ± 4.21 ng/ml varied from 3.9-22.6 ng/ml in group A, 10.89 ± 4.91 ng/ml varied from 2.1-22.6 ng/ml in group B and 22.66 ± 8.01 ng/ml varied from 5.1-26.9 ng/ml in group C. The difference was statistically significant ($p < 0.05$) among the three groups.

Bakacak obtained in their study that vitamin D levels were lower in both preeclamptic and eclamptic patients compared to healthy normotensive pregnant women ($p < 0.001$) Preeclamptic and eclamptic women were similar in terms of the data compared. [16] Vitamin D supplementation is considered to decrease the risk of both preeclampsia and eclampsia in the patient population at risk for vitamin D deficiency. The authors reported that vitamin D level was found to be 23.7 ± 5.93 , 18.5 ± 5.47 and 19.3 ± 4.31 ng/ml in healthy pregnant women, eclamptic women and preeclamptic women, respectively. Vitamin D deficiency is around 66-100% in women with a dark skin color. [17] Vitamin D also has been suggested play a role in major signal and gene regulations in the development of placental trophoblasts in the placental growth phase.

In another study Dabbaghmanesh et al. (2015) a significant difference between the two groups with respect to the mean maternal serum calcium levels was observed (8.9 ± 0.6 vs. 9.3 ± 0.6 mg/dl) ($p < 0.05$). [18] The mean calcium was 8.8 ± 0.6 mg/dl in deficient, 90.6 mg/dl in insufficient and 8.7 ± 0.9 mg/dl in sufficient. The differences were statistically not significant ($p > 0.05$) among the three groups.

Limitations of the study

The present study was conducted in a very short period due to time constraints and funding limitations. The small sample size was also a limitation of the present study.

V. CONCLUSION

This study was undertaken to compare the serum vitamin D and serum calcium level in cases with pre-eclampsia, eclampsia and healthy pregnant woman. This study demonstrates that vitamin D plays a role in the etiology and pathophysiology of preeclampsia. Hypocalcemia in preeclamptic and eclamptic women in this study suggested that serum calcium may have a role in the etiopathogenesis of this disorder.

VI. RECOMMENDATION

This study can serve as a pilot to much larger research involving multiple centers that can provide a nationwide picture, validate regression models proposed in this study for future use and emphasize points to ensure better management and adherence.

ACKNOWLEDGEMENTS

The wide range of disciplines involved in comparison of serum vitamin D and serum calcium level in cases with pre-eclampsia, eclampsia and healthy pregnant woman in Tertiary Level Hospital research means that editors need much assistance from referees in the evaluation of papers submitted for publication. I would also like to be grateful to my colleagues and family who supported me and offered deep insight into the study.

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