

HIGH INCIDENCES OF LOW SERUM MAGNESIUM IN PRE-ECLAMPSIA AND ECLAMPSIA THAN IN NORMAL PREGNANCY

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Abstract: All consenting 50 cases of nor pregnant women and 50 women with pre-eclampsia attending antenatal clinic for antenatal checkup of ≥ 20 who fulfills the inclusion and exclusion criteria were included in this study. Each patient were included only once in the study. Gestational age, parity, socioeconomic status and BMI were matched between cases and controls. History noted and after general physical and obstetric examinations, urine analysis is done to note the extent of proteinuria by dipstick method or by 24 hours urine protein estimation. Then 4 ml of venous blood is drawn from the subjects and sample is analysed for magnesium. Serum magnesium was measured by Calmagite method. Result: The study has been conducted on 100 primigravidae pregnant women. Out of them 50 cases of pre-eclampsia women were in the age group of 18-30 years and belonging from low socio-economic status and the mean serum magnesium was 1.156 ± 0.328 . In contrast out of 50 cases of pregnant women were in the age group of 18-30 years and belonging from low socio-economic status and the mean serum magnesium was 1.907 ± 0.321 . The difference between the mean serum magnesium level in pre-eclampsia women and normal pregnant women cases were statistically significant ($p=0.0016$). From the study presented below it is clear that there are numerous factors that contribute to the causality of pre-eclampsia and from our analysis it was clear that the serum magnesium levels shows an irregular pattern of fluctuations in cases suffering from pre-eclampsia. This irregular behavior of fluctuations in the pre-eclampsia cases can be attributed to numerous physiological causes, some of which are given in our study

Keywords: Eclampsia, pre-eclampsia, proteinuria, serum magnesium.

I. INTRODUCTION

BACKGROUND:

Hypertension in pregnancy is an universal problem complicating 10% of all pregnancies that cause the most detrimental effects to the mother and baby⁽²⁾. In developing countries they rank next to anemia and accounts for 40000 maternal death annually thereby contributing significantly to maternal and perinatal morbidity and mortality⁽³⁾. Preeclampsia is an idiopathic multisystem disorder complicating 6-8% of all pregnancies⁽⁴⁾. The pathophysiology of preeclampsia is the development of abnormal placental vasculature early in pregnancy resulting in decreased relative placental perfusion, hypoxemia, ischemia in turn leading to release of antiangiogenic factors into the maternal circulation altering the endothelial functions resulting in hypertension and other manifestations.⁽⁵⁾ Magnesium is the second most prevalent intracellular cation of which 60% is complexed with calcium in bone.⁽⁷⁾ Magnesium acts as a cofactor for many enzymes, is a peripheral vasodilator and improves glucose tolerance. It has significant effects on cardiac excitability and vascular tone, contractility and reactivity. It is a membrane stabilizer.^(1,8)

OBJECTIVE:

To monitor serum magnesium level in pre-eclampsia , eclampsia and in normal pregnant women.

REVIEW OF LITERATURE:

A P Moholkar et Al(2014) conducted a study on serum calcium and magnesium levels in preeclampsia. This study was conducted in Government Medical Hospital Niraj with 120 subjects. The studied population consisted: group I (40 normal pregnant women) and group II(80 pregnant women with preeclampsia). They concluded that the serum magnesium and calcium levels are found to be significantly decreased in severe preeclamptic group ($p < 0.001$) than that of mild preeclampsia. They found positive and significant correlation ($r = 0.586$) between serum magnesium and calcium. The serum magnesium and calcium were concomitantly decreased in mild and severe cases of preeclampsia.

Abiodun Olusanya, Adekunle O Oguntayo, Aliyu I Sambo (2015) conducted a study on serum levels of calcium and magnesium in preeclamptic- eclamptic patients in a tertiary institution. Study consisted of 48 patients with preeclampsia, 30 patients with eclampsia, and 78 normal pregnant women. All the were either in third trimester or within the puerperium. Results showed that the serum calcium in the preeclamptic and eclamptic patients were significantly lower than in normal pregnant women (2.05 ± 0.4 mmol/L, 1.9 ± 0.2 mmol/L Vs 2.6 ± 0.4 mmol/L, $p < 0.000$). Unlike serum calcium, serum magnesium was lower in the patients with either preeclampsia or eclampsia compared with normal pregnant women but the difference was not statistically significant. This study revealed that serum calcium and magnesium in preeclampsia/eclampsia are lowered compared to normal pregnancy. It was also revealed in this study that serum calcium and magnesium are lower in patients with eclampsia compared to patients with preeclampsia. These findings support the hypothesis that hypocalcaemia and hypomagnesemia may play a role in the pathogenesis of preeclampsia- eclampsia

Idogun E.S ,Imarengiaye C.O , Momoh S.M (2007) conducted a cross sectional study on Extracellular calcium and magnesium in preeclampsia and eclampsia. The study included 11 patients and 23 controls. Result showed plasma calcium was significantly lower in patients than controls (9.2 ± 1.02 vs 9.98 ± 0.87 mg/dl, $p = 0.043$) "t" test. The CSF calcium and magnesium levels were lower in patients than controls (5.66 ± 1.22 Vs 6.67 ± 1.15 mg/dl, $p = 0.043$ and 1.75 ± 0.56 Vs 1.91 ± 0.19 mg/dl, $p < 0.0001$) respectively. Study concluded that there is a Extracellular calcium and magnesium reduction in patients with preeclampsia and eclampsia. Thus reduction may have a cause and effect relationship with these disorders. Zohreh Tavana, Sara Hosseini (2013) conducted a cross sectional study on Comparison of maternal serum magnesium level in preeclampsia and normal pregnant women. Study enrolled 500 pregnant women with gestational age of 18-22 weeks ,26 cases with diagnosis of preeclampsia were detected at the next referral. For each cases, 2 normal pregnant women, at the same gestational age, were considered as the control group. Results showed the initial level of magnesium in preeclampsia women was not only significantly less than the control group (1.81 ± 0.25 mg/dl Vs 2.3 ± 0.44 mg/dl, $p < 0.001$) but also the secondary level was low, when the diagnosis was confirmed (1.72 ± 0.38 mg/dl Vs 2.2 ± 0.63 mg/dl, $p < 0.05$). Thus the study concluded that checking the levels of magnesium should be considered as the predicting factor of preeclampsia during the first evaluation of pregnancy.

Richard Kobina Dadzie Ephraim et Al (2014) conducted a case control study on serum calcium and magnesium levels in women presenting with preeclampsia and pregnancy induced hypertension in the Cape Coast Metropolis, Ghana. This was conducted on 380 pregnant women of which 120 women were pregnancy induced hypertension, 100 women with preeclampsia and 160 healthy, age matched pregnant women (controls). Results showed systolic blood pressure (155.17 ± 10.21) and diastolic blood pressure (101.63 ± 7.84) were significantly raised in women with pregnancy induced hypertension ($p < 0.0001$) and preeclampsia ($p < 0.0001$). Women with hypertensive disorders (preeclampsia and PIH) had significantly lower serum calcium (< 2.1 mmol/L) and serum magnesium (< 1.5 mmol/L) levels than those in the control group (calcium : $2.1-2.8$ mmol/L and magnesium $1.5-2$ mmol/L) with $p < 0.0001$ /each. Of those with PIH, SBP correlated positively with the BMI ($r = 0.575, p < 0.01$) and calcium correlated positively with magnesium ($r = 0.494, p < 0.01$). Multivariate analysis showed that women aged ≥ 40 years were at a significant risk of developing PIH ($r = 2.14, p = 0.000$). Study concluded that serum calcium and magnesium levels are lower in PIH and preeclampsia than in normal pregnancy. Mineral supplementation during the antenatal period may influence significantly the occurrence of hypertensive disorders of pregnancy.

II. DISCUSSION

This is a retrospective study consisting of 50 preeclamptic women (cases) and 50 normal pregnant women (controls), done to study the levels of Serum magnesium levels in both the groups.

Table 1: Frequency distribution of BMI

Frequency Distribution of BMI

Normal Patients		Patients with Eclampsia	
BMI (Kg/m ²)	Frequency	BMI (Kg/m ²)	Frequency
12-14'	0	18-20'	0
14-16'	3	20-22'	4
16-18'	4	22-24'	15
18-20'	6	24-26'	7
20-22'	11	26-28'	9
22-24'	4	28-30'	6
24-26'	8	30-32'	5
26-28'	4	32-34'	2
28-30'	2	34-36'	0
30-32'	6	36-38'	0
Above	0	Above	0
32	2	38	2

Table 2: Descriptive analysis of BMI

Descriptive Analysis of BMI

Normal Patients			Patients with Eclampsia		
BMI	Frequency	Rate of Change	BMI	Frequency	Rate of Change
12-14'	0	0.00	18-20'	0	0.00
14-16'	3	0.03	20-22'	4	0.04
16-18'	4	0.04	22-24'	15	0.15
18-20'	6	0.06	24-26'	7	0.07
20-22'	11	0.11	26-28'	9	0.09
22-24'	4	0.04	28-30'	6	0.06
24-26'	8	0.08	30-32'	5	0.05
26-28'	4	0.04	32-34'	2	0.02
28-30'	2	0.02	34-36'	0	0.00
30-32'	6	0.06	36-38'	0	0.00
Above	0	0.00	Above	0	0.00
32	2	0.02	38	2	0.02

Figure 1

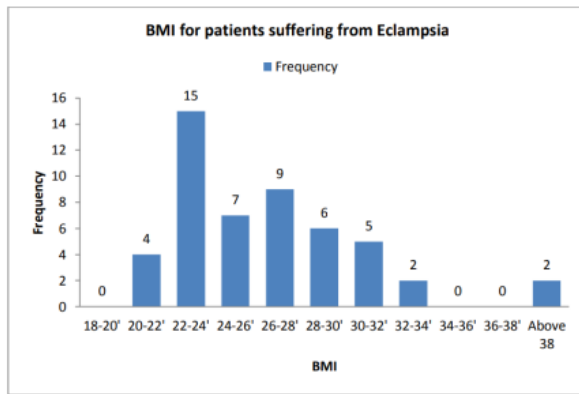
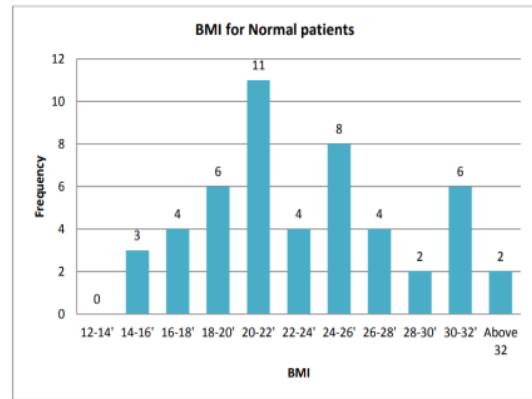


Figure 2



From the above descriptive analysis, we can infer that the BMI group of 22-24 amongst the pregnant women suffering from eclampsia is our target audience as they have a high concentration of the respective case amongst them.

Table 3: Univariate Analysis of Blood Pressure (Eclampsia Cases & Normal Cases)

Table Univariate Analysis of Blood Pressure (Eclampsia Cases)

Eclampsia Cases	Mean	Standard Deviation	Minimum	Maximum
Blood Pressure(Systol)	153.02	12.24993128	130	180
Blood Pressure(Diastol)	93.98	10.22938828	73	120

Table Univariate Analysis of Blood Pressure (Normal Cases)

Normal Cases	Mean	Standard Deviation	Minimum	Maximum
Blood Pressure(Systol)	100.36	14.82243198	70	130
Blood Pressure(Diastol)	59.36	10.15343513	40	80

Figure 3

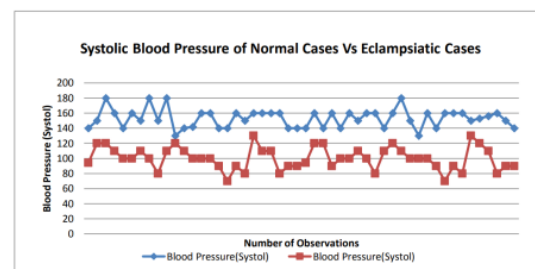
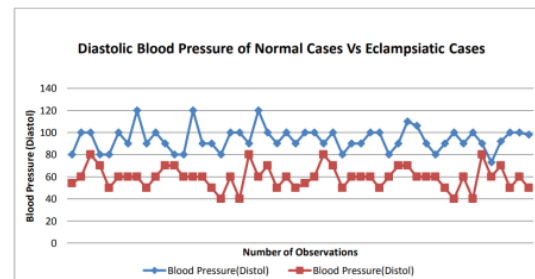


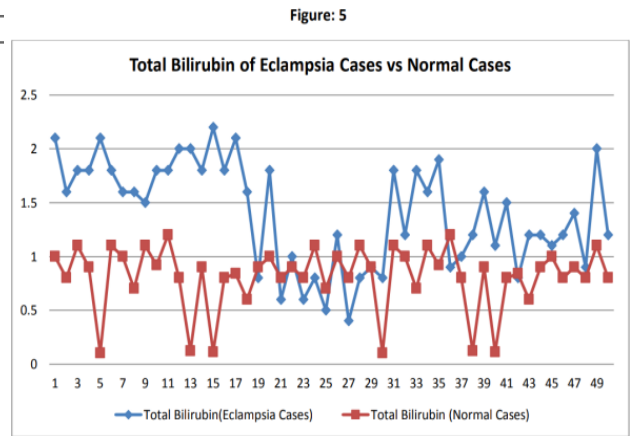
Figure 4



From the above Tables and figures it is concluded that the minimum and the maximum Systolic blood pressure of the Eclampsia cases can reach as low as 130 and as high as 180. This makes it as very sensitive area to be monitored, when discovered with such a case. On the other hand we can also infer that the minimum systolic pressure for the normal cases can reach as low as 70, which is concerning.

Table 4: Descriptive Analysis of the Total Bilirubin concentration

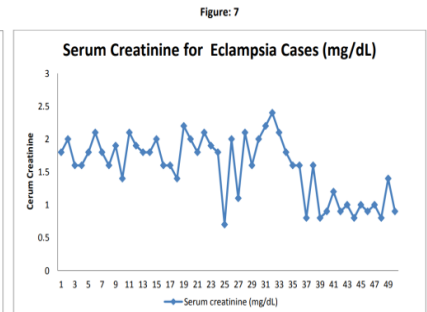
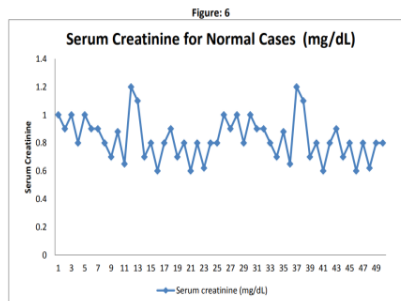
Eclampsia Cases		Normal Cases	
Parameters	Values	Parameters	Values
Mean	1.396	Mean	0.8136
Standard Error	0.069161745	Standard Error	0.042136
Median	1.5	Median	0.9
Mode	1.8	Mode	0.8
Standard Deviation	0.489047387	Standard Deviation	0.297944
Sample Variance	0.239167347	Sample Variance	0.08877
Kurtosis	-1.089960905	Kurtosis	1.440144
Skewness	-0.236526305	Skewness	-1.41856
Range	1.8	Range	1.1
Minimum	0.4	Minimum	0.1
Maximum	2.2	Maximum	1.2
Sum	69.8	Sum	40.68
Count	50	Count	50
Confidence Level (95.0%)	0.138985727	Confidence Level (95.0%)	0.084675



From the above table and figure it is concluded that Patients suffering Eclampsia tend to have **higher Bilirubin levels**, reaching at most double the normal upper limit. This could be a key marker in Eclampsia.

Table 5: Descriptive Analysis of Serum Creatinine

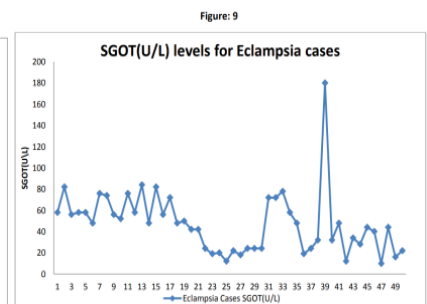
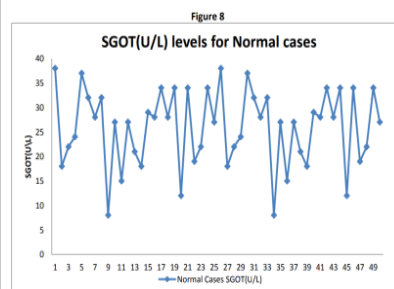
Normal Cases		Eclampsia Cases	
Parameters	Values	Parameters	Values
Mean	0.83	Mean	1.576
Standard Error	0.02135798	Standard Error	0.066734931
Median	0.8	Median	1.6
Mode	0.8	Mode	1.6
Standard Deviation	0.15102372	Standard Deviation	0.471887223
Sample Variance	0.02280816	Sample Variance	0.222677551
Kurtosis	0.01039345	Kurtosis	-1.036526204
Skewness	0.49789937	Skewness	-0.442999389
Range	0.6	Range	1.7
Minimum	0.6	Minimum	0.7
Maximum	1.2	Maximum	2.4
Sum	41.5	Sum	78.8
Count	50	Count	50
Confidence Level (95.0%)	0.04292046	Confidence Level (95.0%)	0.134108862



From the above table it is concluded that patients suffering from Eclampsia show higher levels of Serum Creatinine levels, reaching double the normal upper limit at times. This could be a key marker for studying and tracing the presence of Eclampsia

Table 6: Descriptive Analysis of SGOT levels

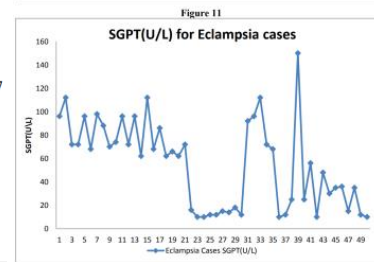
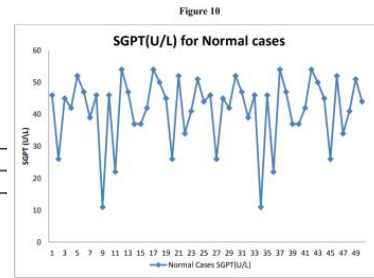
Normal Cases		Eclampsia Cases	
Parameters	Values	Parameters	Values
Mean	25.67346939	Mean	47.30612245
Standard Error	1.099392131	Standard Error	4.145853194
Median	27	Median	48
Mode	34	Mode	48
Standard Deviation	7.695744915	Standard Deviation	29.02097236
Sample Variance	59.2244898	Sample Variance	842.2168367
Kurtosis	-0.425073039	Kurtosis	7.780989949
Skewness	-0.515886705	Skewness	1.992308459
Range	30	Range	170
Minimum	8	Minimum	10
Maximum	38	Maximum	180
Sum	1258	Sum	2318
Count	49	Count	49
Confidence Level (95.0%)	2.210475991	Confidence Level (95.0%)	8.335796385



From the above descriptive analysis it is clear that the SGOT levels fluctuates within the normal range for normal cases but in case of Eclampsia cases the SGOT levels fluctuate beyond the normal range. This observation could serve as a good indicator for the presence of Eclampsia in cases.

Table 7: Descriptive Analysis of SGPT levels

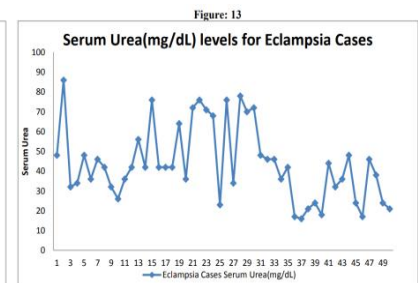
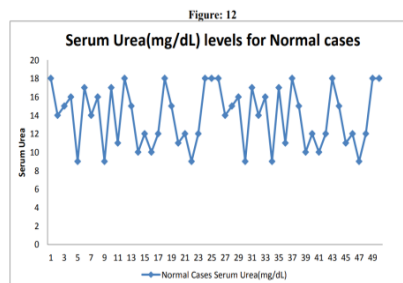
Normal Cases		Eclampsia Cases	
Parameters	Values	Parameters	Values
Mean	41.44	Mean	55.36
Standard Error	1.496161074	Standard Error	5.19110385
Median	45	Median	62
Mode	46	Mode	96
Standard Deviation	10.57945641	Standard Deviation	36.70664734
Sample Variance	111.924898	Sample Variance	1347.377959
Kurtosis	1.266614757	Kurtosis	-0.822683847
Skewness	-1.25531797	Skewness	0.289282133
Range	43	Range	140
Minimum	11	Minimum	10
Maximum	54	Maximum	150
Sum	2072	Sum	2768
Count	50	Count	50
Confidence Level(95.0%)	3.006648188	Confidence Level(95.0%)	10.43191355



From the above descriptive analysis, **cases suffering from Eclampsia show a high degree of fluctuation in their SGPT levels as compared to the normal cases.** This could be a clear indicator of Eclampsia as the cases tend to have a high SGPT levels in their system.

Table 8: Descriptive analysis of Serum Urea

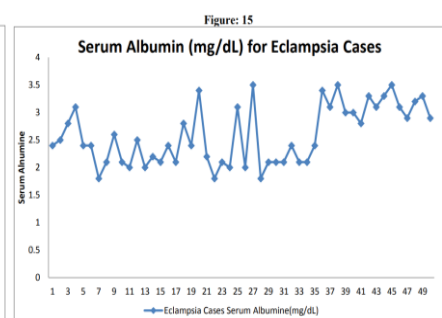
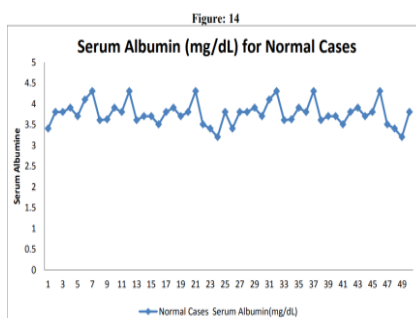
Normal Cases		Eclampsia Cases	
Parameters	Values	Parameters	Values
Mean	13.84	Mean	43.84
Standard Error	0.45117534	Standard Error	2.64349182
Median	14	Median	42
Mode	18	Mode	42
Standard Deviation	3.19029139	Standard Deviation	18.6923099
Sample Variance	10.1779592	Sample Variance	349.402449
Kurtosis	-1.410073	Kurtosis	-0.5454671
Skewness	-0.0997824	Skewness	0.56173905
Range	9	Range	70
Minimum	9	Minimum	16
Maximum	18	Maximum	86
Sum	692	Sum	2192
Count	50	Count	50
Confidence Level(95.0%)	0.90667077	Confidence Level(95.0%)	5.31229559



From Table 8, It is clear that the serum urea remains within the normal levels in both the cases but in case of Eclampsia cases, the serum urea levels tends to be higher than the Normal patients. As a matter of fact an erratic behavior is also noticed in Eclampsia cases. Eclampsia cases tend to have a relatively high serum urea concentration than the Normal cases.

Table 9: Descriptive Analysis of Serum Albumin

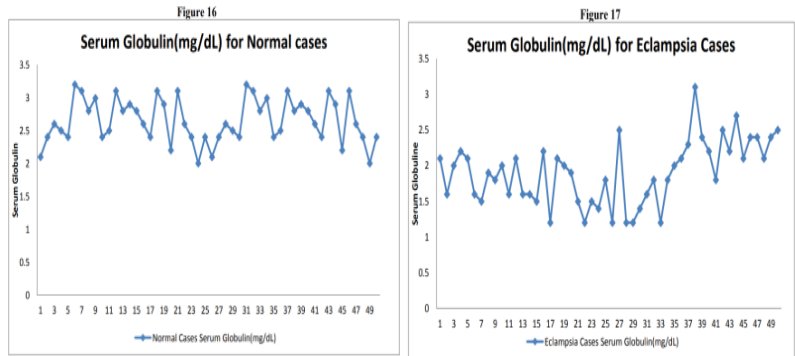
Normal Case		Eclampsia Cases	
Parameters	Values	Parameters	Values
Mean	3.7648	Mean	2.586
Standard Error	0.038876298	Standard Error	0.07526877
Median	3.8	Median	2.4
Mode	3.8	Mode	2.1
Standard Deviation	0.274896938	Standard Deviation	0.53223058
Sample Variance	0.075568327	Sample Variance	0.28326939
Kurtosis	0.109675688	Kurtosis	-1.3085442
Skewness	0.363838242	Skewness	0.28681821
Range	1.1	Range	1.7
Minimum	3.2	Minimum	1.8
Maximum	4.3	Maximum	3.5
Sum	188.24	Sum	129.3
Count	50	Count	50
Confidence Level(95.0%)	0.078124844	Confidence Level(95.0%)	0.15125825



From the analysis carried out above, it is clear that the Serum Albumin levels remains within the natural levels for Normal cases where as the **Serum Albumin levels for the Eclampsia cases remain below the natural level on an average.** Moreover, the Serum Albumin levels show an erratic behavior in Eclampsia cases.

Table 10: Descriptive Analysis of Serum Globulin

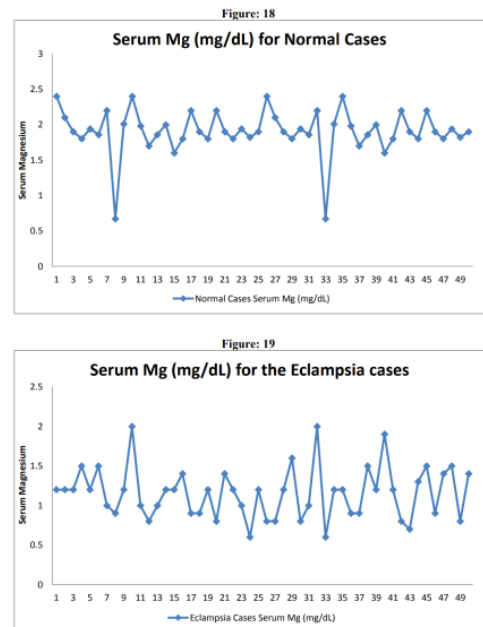
Normal cases		Eclampsia Cases	
Parameters	Values	Parameters	Values
Mean	2.6516	Mean	1.902
Standard Error	0.047599829	Standard Error	0.062824017
Median	2.6	Median	1.95
Mode	2.4	Mode	2.1
Standard Deviation	0.336581615	Standard Deviation	0.444232886
Sample Variance	0.113287184	Sample Variance	0.197342857
Kurtosis	-0.986002274	Kurtosis	-0.289334407
Skewness	-0.038768559	Skewness	0.20150766
Range	1.2	Range	1.9
Minimum	2	Minimum	1.2
Maximum	3.2	Maximum	3.1
Sum	132.58	Sum	95.1
Count	50	Count	50
Confidence Level(95.0%)	0.095655435	Confidence Level(95.0%)	0.126249587



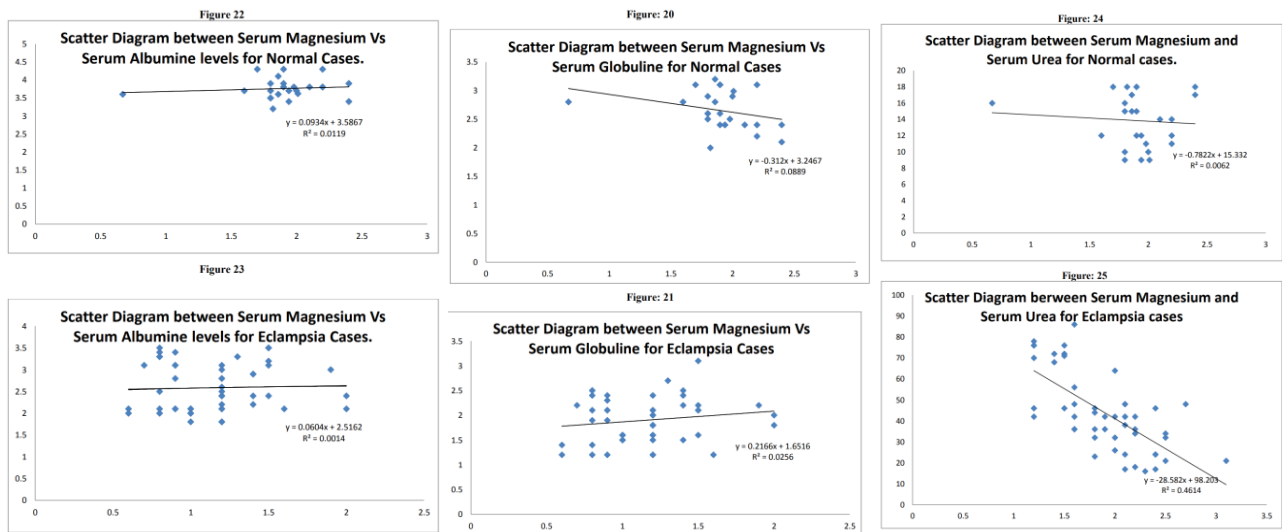
For the analysis carried out above, it is clear that the Serum Globulin levels for the normal cases varies within the natural level. On the other hand, cases suffering from **Eclampsia** have their **Serum Globulin levels below the natural level.**

Table 11: Descriptive Analysis of Serum Magnesium

Normal Cases		Eclampsia Cases	
Parameters	Values	Parameters	Values
Mean	1.9072	Mean	1.156
Standard Error	0.045471714	Standard Error	0.046437142
Median	1.9	Median	1.2
Mode	1.9	Mode	1.2
Standard Deviation	0.32153357	Standard Deviation	0.328360181
Sample Variance	0.103383837	Sample Variance	0.107820408
Kurtosis	7.580591427	Kurtosis	0.41921398
Skewness	-2.06341707	Skewness	0.656683722
Range	1.73	Range	1.4
Minimum	0.67	Minimum	0.6
Maximum	2.4	Maximum	2
Sum	95.36	Sum	57.8
Count	50	Count	50
Confidence Level(95.0%)	0.091378828	Confidence Level(95.0%)	0.093318929



From the descriptive analysis carried out above it is clear that the Serum Magnesium levels are lower in the Eclampsia cases when compared with the normal cases. It is clear that the Serum Magnesium levels are lower and vary in an erratic fashion in Eclampsia cases than in the Normal cases. The Mean Serum Magnesium level in case of Normal cases is 1.907 mg/dL with a standard deviation of 0.321 mg/dL. Similarly if we look at the Mean Serum Magnesium levels for Eclampsia cases then we can infer that 1.156 mg/dL with a standard deviation of 0.328 mg/dL. But if we observe closely, then we can infer that the average Serum Magnesium levels for the Eclampsia cases are slightly lower than the Normal cases by 0.751 mg/dL.

Comparative Analysis of Linear trend between Auxiliary Parameters and Serum Magnesium:

From the above linear trend analysis, it is clear that Serum magnesium has a lower degree of linear association with the other Serum parameters in the Blood. It seems that the Serum Magnesium has no direct linear relationship with the other parameters, which in turn implies that they have no one one correspondence.

But on the other hand, from figure 25 we can clearly see that the Serum Urea has a high degree of linear association with Serum Magnesium levels. The Coefficient of Correlation between them being 0.461.

This clearly indicates that they probably have a one one correspondence between them.

III. CONCLUSION

In our study, a reduction of serum magnesium levels is seen in preeclampsia and eclampsia cases compared to normal pregnant women. It was also established in this study that the magnesium in patients with severe preeclampsia and eclampsia were less compared to the normal patients. In this study, both maternal and neonatal complications were more in preeclampsia cases where the serum magnesium levels is decreased. These findings support the hypothesis that hypomagnesaemia is possible etiology of preeclampsia and help in establishing strategies for prevention and reduction of severity of the disease. Needs further studies to find out whether estimation of magnesium at an early gestation age can be used as a predictive marker for early diagnosis of preeclampsia and supplementation with these nutrients in early pregnancy can be a preventive tool in preeclampsia.

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