ISSN-Online: 2320-787
ISSN-Print: 2319-1775

ORIGINAL ARTICLE

The Association Between Dietary Factor of Low Level Magnesium and Development of Pre-eclampsia and Eclampsia

Dr. Chaitali Mondal[1], Dr. Dipak Das[2]

[1,2]CMJ University, West Bengal University of Health Science, [1,2]South Dumdum Municipal Hospital, Kolkata, India

ABSTRACT All consenting 300 cases of normal level of serum magnesium pregnant women and 300 women with low level of serum magnesium attending antenatal clinic for antenatal checkup of >/= 20 weeks who fulfills the inclusion and exclusion criteria were included in the 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.

Results: Of the 300 cases of low serum magnesium level primigravida pregnant women, 24 developed pre-eclampsia and 2 developed eclampsia. The subjects were primigravida in the age group of 18-30 years and belonging from low socio-economic status. The mean serum magnesium was 1.137+/-0.280 in the cases of low level of serum magnesium. In contrast out of 300 cases of normal level of serum magnesium primigravida pregnant women, 6 developed pre-eclampsia. The subjects were primigravida in the age group of 18-30 years and belonging from low socio-economic status. The mean serum magnesium was 1.921+/-0.322 in the cases of normal level of serum magnesium. Odd ratio is 4.65 which indicates, it is highly significant as the value is more than 1. The difference between the mean serum magnesium level in low level of serum magnesium cases and normal level of serum magnesium cases was statistically significant (p = 0.0018).

Keywords: Eclampsia, Pre-eclampsia, Proteinuria, Serum magnesium

Address for correspondence: Dr. Chaitali Mondal, CMJ University, West Bengal University of Health Science, Kolkata, West Bengal 700064, India.

Submited: 19-Dec-2020 **Accepted:** 17-Jun-2021 **Published:** 26-Jul-2021

INTRODUCTION

Background

Hypertension is one of the most frequently encountered medical disorder in obstetrics practice and remain a major cause of maternal, fetal and neonatal morbidity and mortality. The present study was undertaken to compare the maternal serum magnesium levels in pre-eclampsia, eclampsia and in normal pregnant women.

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).

Access this article online
Website: www.ijfans.org
DOI: 10.4103/ijfans_19_21

How to cite this article: Dr. Chaitali Mondal, Dr. Dipak Das. The Association Between Dietary Factor of Low Level Magnesium and Development of Pre-eclampsia and Eclampsia. Int J Food Nutr Sci 2021;10:23-34.

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).

Hypothesis

Based on the study following hypothesis is formulated

H1: There is a significant association between dietary factors of low level of Magnesium and development of pre-eclampsia and eclampsia.

OBJECTIVE

To find out the association between dietary factor of low magnesium and development of pre-eclampsia and eclampsia.

Literature Review

Shilpa Mittal *et al.* (2014) conducted a study on Comparison of serum calcium and magnesium levels between preeclamptic and normotensive healthy pregnant women. Study consisted of 100 preeclamptic women in group 1 and group 2 included 100 age matched healthy pregnant women. Results showed serum levels of calcium (8.27+/-0.37 mg/dl Vs 9.06+/-0.27 mg/dL) and magnesium (1.99+/-mEq/L Vs 2.03+/-0.13 mEq/L) were significantly lower in preeclamptic women than the control group. Study found that hypocalcaemia and hypomagnesemia are seen in the preeclamptic women may be responsible for the vascular pathology associated with onset of preeclampsia. Hence concluded that adjuvant supplementation of calcium and magnesium may prevent further progression of preeclampsia.

Anjum K Saturday, Alka N Sonttake (2013) conducted a cross sectional study on Electrolyte status in preeclampsia. Study subject compromised of three groups aged between 18-35 years. Group 1-preeclampsia women, group 2-normal pregnant women,group 3-normal healthy controls. Serum was analysed for estimation of calcium, magnesium, sodium and potassium. Results showed reduced levels of serum calcium (7.4+/-0.55 mg/dl; 8.68+/-2.5 mg/dl; 9.61+/-0.95 mg/dl), serum magnesium (1.28+/-1.08; 1.80+/-0.47; 2.31+/-0.35 mg/dl), serum potassium (3.37+/-0.25; 3.54+/-0.18; 3.77+/-0.32 mmol/L) and increased level of sodium (144.9+/-2.8; 138.2+/-3.11; 132.6+/-4.4 mmol/L) in patients of preeclampsia as compared to normal pregnant women and normal healthy controls respectively. Hence concluded that adjuvant supplementation of calcium, magnesium and potassium with the dietary restriction of sodium may prevent further progression of preeclampsia.

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, p0.043 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 Hossenmirzaei (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.

Jagannath Pairu, Triveni G S, Ankitha Manohar (2015) conducted a comparative study of serum calcium and magnesium in pregnancy induced hypertension and normal pregnancy. Study was undertaken in 100 pregnant women. Data for the study was collected from 50 normotensive pregnant women with more than 20 weeks of gestational age (control group) and 50 PIH patients (study group). Results showed that the mean serum calcium is significantly lower in PIH group (8.15+/-0.37 mg/dl) compared to normal pregnancy (9.16+/-0.82 mg/dl). The mean serum magnesium is lower in PIH group (1.78+/-0.7 mEq/L) than normal pregnancy (2.08+/-0.46 mEq/L) which is moderately significant. The study concluded that the serum calcium and magnesium levels are decreased in PIH patients compared to normotensive normal pregnant women, suggesting the possible role of calcium and magnesium in etiopathophysiology of pregnancy induced hypertension.

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.

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.

Heiner C. Butcher *et al.* (1996) conducted a study on Effect of calcium supplementation on pregnancy induced hypertension and preeclampsia. A meta-analysis of randomised controlled trials. Data source was from MEDLINE and EMBASE for 1966 to May 1994. Study selection included fourteen randomised trials involving 2459 women were eligible. The pooled analysis showed a reduction in systolic blood pressure of -5.40 mmHg (95% confidence interval, -7.81 to -3.00 mmHg; $p < 0.001$) and in diastolic blood pressure of -3.44 mmHg (95% CI, -5.20 to -1.68 mmHg; $p < 0.001$). The odds ratio for preeclampsia in women with calcium supplementation compared with placebo was 0.38 (95%,CI, 0.22 to 0.65). The study concluded that the calcium supplementation during pregnancy leads to an important reduction in systolic and diastolic blood pressure and preeclampsia. While pregnant women at risk of preeclampsia should consider taking calcium, many more patient events are needed to confirm calcium's impact on maternal and fetal morbidity.

RESULTS AND DISCUSSION

This is a comparative prospective study consisting of 300 pregnant women with Low level of Serum Magnesium (cases) and 300 women with Normal level of Serum Magnesium (controls), done to study the association between dietary factor of low magnesium and development of pre-eclampsia and eclampsia, who fulfills the inclusion and exclusion criteria at SDDM Hospital, Kolkata between November 2018 to November 2019. The software used to analyze the data is "R Project for Stastical Computing".

INCLUSION CRITERIA

Control Group: Primigravida pregnant women of >/= 20 weeks, Lower socio-economic class strata, Normal Serum Magnesium Level, Patient with or without conclusions, Normotensive or hypertensive pregnant women.

Study Group: Primigravida pregnant women of >/= 20 weeks, Lower socioeconomic class strata, Normotensive or hypertensive pregnant women, Low Serum Magnesium Level, Patient with or without convulsions.

EXCLUSION CRITERIA

Medical conditions like chronic hypertension, renal disease, cardiovascular disease, liver disease, diabetes mellitus and other endocrine disorders, Pregnancy with multiple gestation, hydatiform mole and other secondary causes of hypertension, Malignancy, Hematological disorders, Women who smoke, consume alcohol and any drug consumption, Women treated with antiepileptic drugs, Autoimmune diseases.

From the Tables 1, 2 and Figures 1, 2 Individuals having Normal levels of Serum Magnesium tend to have their corresponding BMI in between 18-21 and 24-27, whereas Individuals having Lower levels of Serum Magnesium tend to have their corresponding BMI between 21-24 and 24-27.

Table 1: Frequency Distribution of BMI

Normal Level of Serum Mg^{2+} Cases		Cases with Low Serum Mg^{2+} Levels	
BMI	**Frequency**	**BMI**	**Frequency**
12-15'	0	12-15'	0
15-18'	32	15-18'	0
18-21'	87	18-21'	0
21-24'	49	21-24'	132
24-27'	74	24-27'	108
27-30'	24	27-30'	36
30-33'	34	30-33'	24
Total	300		300

Table 2: Relative Frequency of BMI

Normal Level of Serum Mg^{2+} Cases			Caseswith Low Serum^{M2+g} Levels		
BMI	Frequency	Relative Frequency	BMI	Frequency	Relative Frequency
12-15'	0	0	12-15'	0	0
15-18'	32	0.11	15-18'	0	0
18-21'	87	0.29	18-21'	0	0
21-24'	49	0.16	21-24'	132	0.44
24-27'	74	0.25	24-27'	108	0.36
27-30'	24	0.08	27-30'	36	0.12
30-33'	34	0.11	30-33'	24	0.08
Total	300	1		300	1

Figure 1: Histogram Based on the BMI for Cases with Normal Levels of Serum Magnesium

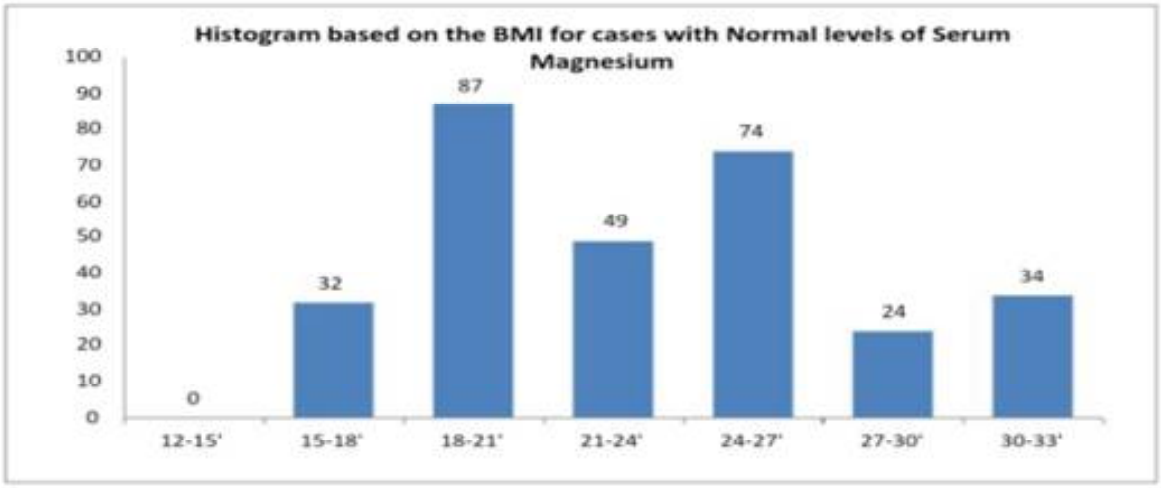
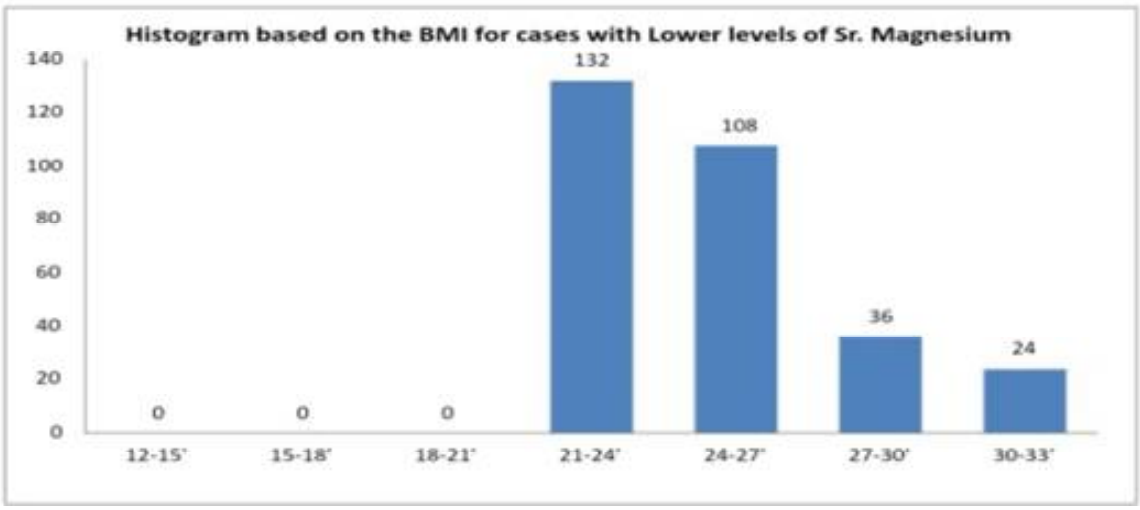


Figure 2: Histogram Based on the BMI for Cases with Lower Levels of Sr. Magnesium



From the analysis of the above Tables 3 to 6 and Figures 3 to 6, it is evident that individuals with lower serum magnesium levels tend to have a high systolic BP of 140 or above and a diastolic BP of 90 or above. This is one of the key features in the development of Pre-Eclampsia and Eclampsia. Furthermore this discrepancy was further validated with a p-value of 0.0031 for the systolic BP and a p-value of 0.0047 for the Diastolic BP.

From Tables 7 and 8, it is clear that individuals with lower serum magnesium levels having pre-eclampsia and eclampsia have a significant amount of proteinuria, i.e., 3 gm/day or more.

BMI ANALYSIS

Report Based on BMI Analysis

The following report is based on the BMI analysis carried out on the data supplied by the Pilot Survey. From the above tables and Histograms we can conclude few important features regarding the BMI of the corresponding cases. In our above given analysis we have divided the various BMIs into Bins of size 3 units.

From Table 7, we can clearly see that for cases with normal levels of magnesium, the highest concentration of BMI is in the BMI bin 18-21, i.e., 87 individuals. And as we move from the top to the bottom of the table for the corresponding case we can see that there is a steep rise in the frequency of bins as we move from 15-18 to 18-21 and a steep fall in the frequency as we move from 18-21 to 21-24. This clearly indicates that majority of the individuals in this population have their BMI lying between 18-21.

On the other hand, if we look at the case of Low levels of Magnesium, then from the same table (Table 7) we can clearly observe that the highest concentration of BMI lies in the bin 21-24 and it gradually decreases as we move towards higher bins of BMI. In the corresponding case it is clearly visible that 132 individuals have their BMI within the limit 21-24. This clearly indicates that majority of the individuals having lower levels of Magnesium have their BMI between 21-24.

This situation can be understood with more clarity if we look at Table 8 and Figures 1 and 2 along with it. From Table 8 we can see that for cases with Normal levels of Magnesium, the relative frequency for the BMI group 18-21 and 24-27 are 0.29 and 0.25 respectively, which in turn accounts for 29% and 25% of the total accounted population under the following case. Similarly for the cases of lower levels of Magnesium, the relative frequency for the BMI group 21-24 is 0.44 which accounts for 44% of the total accounted population under the following case and 0.36 for the BMI group 24-27, which accounts for 36% of the total accounted population.

Table 3: Frequency Distribution of Systolic Blood Pressure

Systolic BP, Normal Cases		Systolic BP, Cases with Low Serum Mg^{2+} Levels	
Bins	Frequency	Bins	Frequency
70-80'	10	70-80'	0
80-90'	33	80-90'	0
90-100'	49	90-100'	0
100-110'	87	100-110'	0
110-120'	67	110-120'	95
120-130'	47	120-130'	119
130-140'	1	130-140'	60
140 and more	6	140 and more	26
Total	300	Total	300

Table 4: Frequency Distribution of Diastolic Blood Pressure

Diastolic BP, Normal Cases		Diastolic BP, Cases with Low Serum Mg^{2+} Levels	
Bins	Frequency	Bins	Frequency
40-50'	21	40-50'	0
50-60'	55	50-60'	0
60-70'	150	60-70'	0
70-80'	44	70-80'	82
80-90'	22	80-90'	132
90 and more	8	90 and more	86

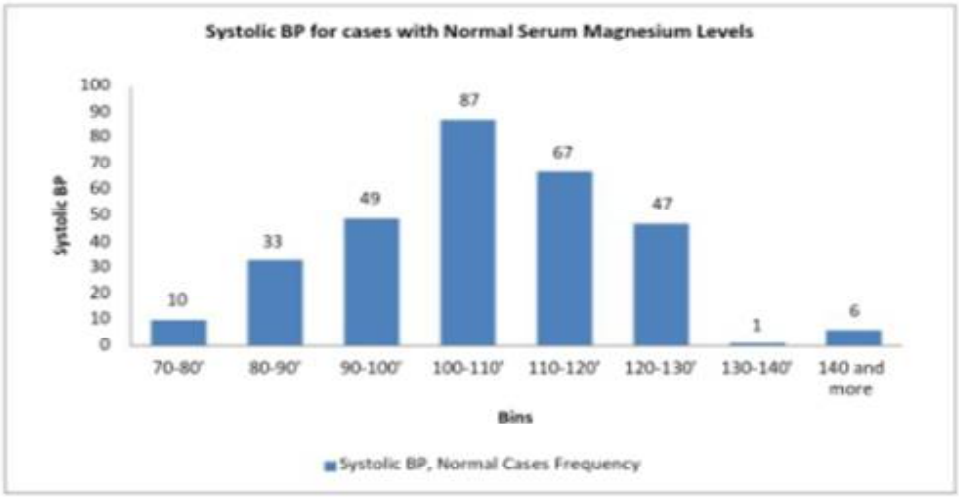
Table 5: Blood Pressure Analysis of Normal Level of Serum Magnesium Cases

Normal Cases	Mean	Median	Maximum	Minimum	Std. Dev
Systole	101.6266667	100	190	70	16.051567
Diastole	60.50666667	60	114	40	11.61175

Table 6: Blood Pressure Analysis of Low Level of Serum Magnesium Cases

Cases with Low Mg^{2+} Levels	Mean	Median	Maximum	Minimum	Std. Dev
Systole	121.16	120	190	104	16.487182
Diastole	79.36	80	120	62	10.358962

Figure 3: Systolic BP for Cases with Normal Serum Magnesium Levels



Inference

Individuals having Normal levels of Serum Magnesium tend to have their corresponding BMI in between 18-21 and 24-27 (from Tables 7, 8 and Figures 1, 2), whereas Individuals having Lower levels of Serum Magnesium tend to have their corresponding BMI between 21-24 and 24-27.

This clearly indicates that our target audience for investigating lower levels of Serum Magnesium, are the ones with their corresponding BMI within the range 21-27.

Blood Pressure Analysis

Report

The following report is based on the blood pressure analysis carried out in the tables and charts given above. Here we have constructed Bins of systolic and diastolic blood pressure of size 10 and units each. The normal blood pressure, i.e., Systolic BP/Diastolic BP is 120/80 for a normal human being.

The average blood pressure of the cases with normal serum magnesium levels is 101/60 with a maximum of 190/114 and a minimum of 70/40. Similarly the average blood pressure for the cases with lower levels of serum magnesium is 121/79 with a maximum of 190/120 and a minimum of 104/62.

From Table 9, we can clearly see that majority of the individuals having normal serum Magnesium Levels tend to have their systolic blood pressure within the range 100-110. That is 87 individuals lie in this range of systolic BP. And as we move towards the higher bins the concentration of the individuals gradually decreases. Further, if we look at table 10 and the corresponding histogram (Figure 3) then we can clearly see that 6 individuals possess a systolic BP of 140 and above. Similarly from Figure 4 (Table 9), we can clearly see that majority of the individuals with lower levels of Serum Magnesium tend to have their systolic BP higher than 120. About 205 individuals tend to have their systolic BP higher than 120. Further is we move towards the higher bins then we can see that 119 individuals have their systolic BP within the range 120-130, 60 individuals within the range 130-140 and 26 individuals with their systolic BP 140 or above.

From Table 10, we can clearly see that the majority of the individuals with normal serum magnesium levels tend to have their diastolic BP within the range 60-70. That is, 150 individuals have their diastolic BP within the range 60-70. Further as we move towards the higher bins we can clearly see that the diastolic BP decreases rapidly, i.e., 44 individuals tend to have their diastolic BP within the range 70-80, 22 individuals within the range 80-90 and 8 individuals with their diastolic BP 90 or above. This following can be understood more clearly if we look at the histogram at Figure 5. Similarly, if we look at the diastolic BP of the cases with lower serum magnesium levels, i.e., at Figure 6, then we can clearly see that the majority of the individuals tend to have their diastolic BP within the range 80-90. That is, 132 individuals tend to have their diastolic BP within the range of 80-90. Further we can clearly see that 86 individuals tend to have their diastolic BP 90 or above.

Figure 4: Systolic BP for Cases with Lower Serum Magnesium Levels

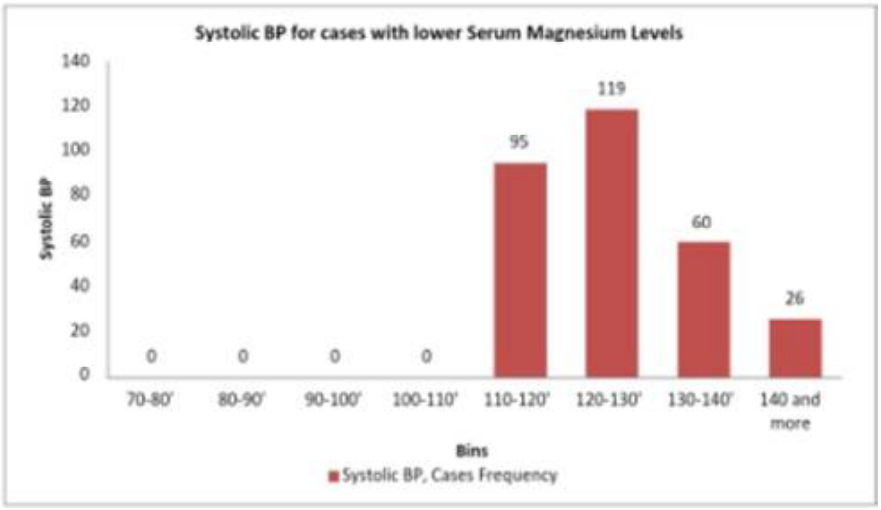


Figure 5: Diastolic BP for Cases with Normal Serum Magnesium Levels

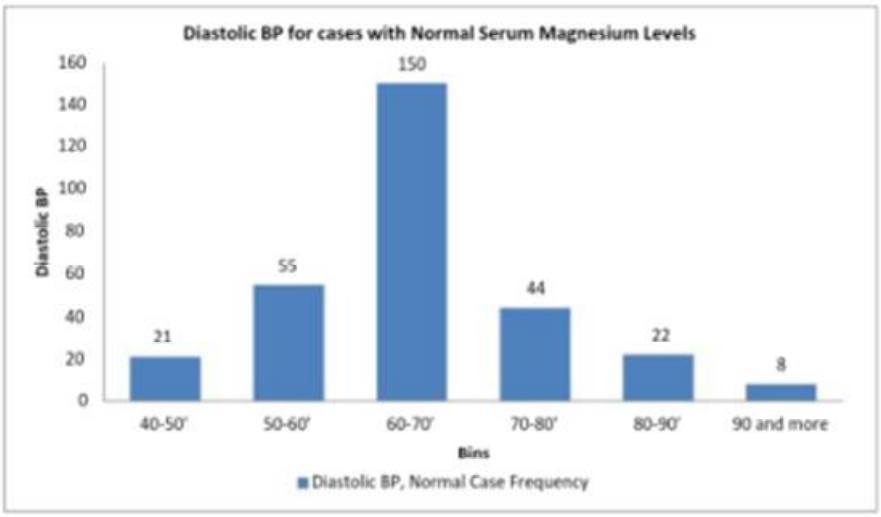


Figure 6: Diastolic BP for Cases with Lower Levels of Serum Magnesium Levels

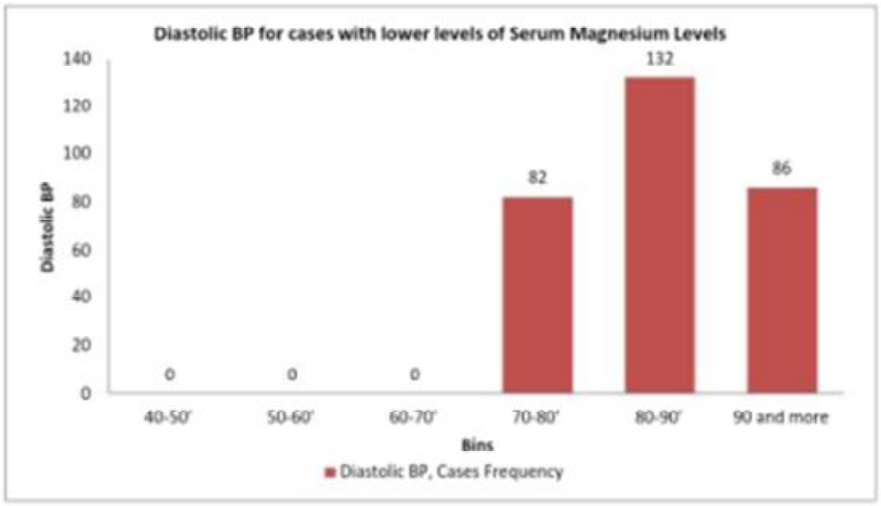


Table 7: Frequency Distribution of Proteinuria for Normal Level of Serum Magnesium Cases

Cases with Normal Serum Magnesium	Systolic BP <	Systolic BP >
Levels	140	140
Proteinuria < 3 grams/Day	294	0
Proteinuria > 3 grams/Day	0	6
Cases with Normal Serum Magnesium Levels	**Diastolic BP < 90**	**Diastolic BP > 90**
Proteinuria < 3 grams/Day	292	0
Proteinuria > 3 grams/Day	0	8

Table 9: Descriptive Analysis of Serum Magnesium

Cases with Normal Serum Mg^{2+} Levels		Cases with Low Serum Mg^{2+} Levels	
Parameters	**Values**	**Parameters**	**Values**
Mean	1.921866667	Mean	1.137333333
Standard Error	0.018640217	Standard Error	0.016220975
Median	1.9	Median	1.2
Mode	1.9	Mode	1.2
Standard Deviation	0.322858029	Standard Deviation	0.280955528
Sample Variance	0.104237307	Sample Variance	0.078936009
Kurtosis	6.775548591	Kurtosis	1.694414551
Skewness	2.039746662	Skewness	0.891316001
Range	1.73	Range	1.4
Minimum	0.67	Minimum	0.6
Maximum	2.4	Maximum	2
Sum	576.56	Sum	341.2
Count	300	Count	300
Confidence		Confidence	
Level (95.0%)	0.036682635	Level (95.0%)	0.031921737

Inference

From the above analysis, it is evident that individuals with lower serum magnesium levels tend to have a high systolic BP of 140 or above and a diastolic BP of 90 or above. This is one of the key features in the development of Pre-Eclampsia and Eclampsia.

Table 8: Frequency Distribution of Proteinuria for Low Level of Serum Magnesium Cases

Cases with Low Serum Magnesium Levels	Systolic BP < 140	Systolic BP > 140
Proteinuria < 3 grams/Day	274	0
Proteinuria > 3 grams/Day	0	26
Cases with Low Serum Magnesium Levels	**Diastolic BP < 90**	**Diastolic BP > 90**
Proteinuria < 3 grams/Day	271	0
Proteinuria > 3 grams/Day	0	29

Table 10: Frequency Distribution of Serum Magnesium

Frequency Distribution, Normal Serum Mg^{2+}		Frequency Distribution, Lower Serum Mg^{2+}	
Bin	**Frequency**	**Bin**	**Frequency**
0.5'	0	0.5'	0
0.5-1'	0	0.5-1'	135
1-1.5'	0	1-1.5'	165
1.5-2'	194	1.5-2'	0
2-2.5'	106	2-2.5'	0
Total	300	Total	300

Furthermore this discrepancy was further validated with a p-value of 0.0031 for the systolic BP and a p-value of 0.0047 for the Diastolic BP.

Relationship Between Proteinuria and Blood Pressure

Report

From Tables 13 and 14, it is clear that individuals with lower serum magnesium levels having pre-eclampsia and eclampsia have a significant amount of proteinuria, i.e., 3 gm/day or more.

Analysis on Serum Magnesium

Report

The normal range for the Serum Magnesium level is 1.7-2.2 mg/dL. From Table 15, It is clear that the average Serum Magnesium Levels for the individuals for the former case lies within the normal range where as for the latter case it lies below normal range.

The following observation can also be made clear if we compare measures of central tendency, that is, Mean, Median and Mode of the corresponding distributions. The Mean, Median and

Mode of the Normal Serum Magnesium Levels are 1.921 mg/dL, 1.9 mg/dL and 1.9 mg/dL with a standard deviation of 0.322 mg/dL where as the same for the Low Serum Magnesium Levels distribution are 1.137 mg/dL, 1.2 mg/dL, 1.2 mg/dL with a standard deviation of 0.280 mg/dL.

The following observation must be significant as it has a p-value of 0.0018. This clearly indicates that the mean of the two distributions are not the same.

Graphical Interpretation of Serum Magnesium Levels

From Figure 9 we can see that the Serum Magnesium levels vary in a regular fashion in Normal cases. It shows a recursive movement or pattern as we move along the number of patients. In Normal cases we can see that the erratic fluctuations are low compared to that of the cases in Figure 10. From Figure 10 it is clear that the Serum Magnesium levels show an erratic movement in Cases with low Serum Mg level. It fluctuates in an erratic fashion and show signs of anomaly.

Inference

From the descriptive analysis carried out above it is clear that the Serum Magnesium levels are lower in the pre-eclampsia and 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 low serum magnesium cases than in the normal serum magnesium cases.

From the descriptive analysis carried out from the Tables 9, 10 and Figures 7 to 10, it is clear that the Serum Magnesium levels are lower in the pre-eclampsia and eclampsia cases when

Figure 7: Frequency Distribution of Cases with Normal Serum Magnesium Levels

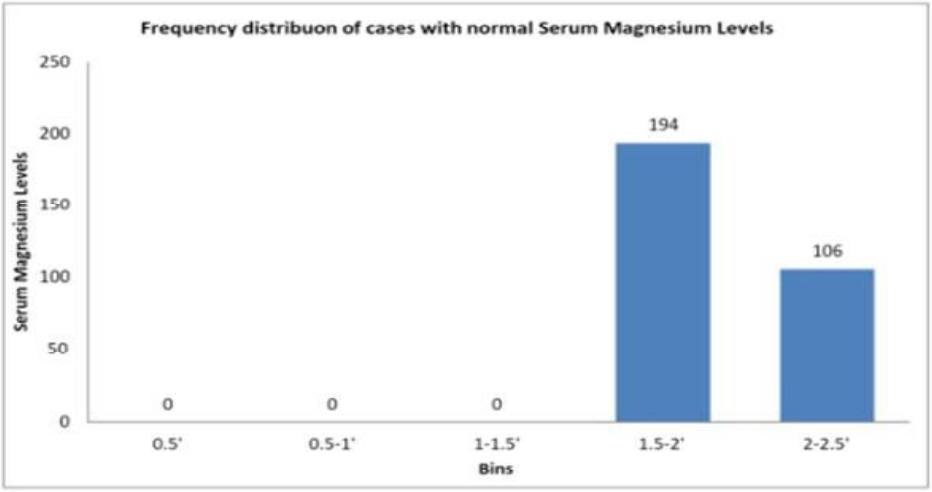


Figure 8: Frequency Distribution of Cases with Lower Serum Magnesium Levels

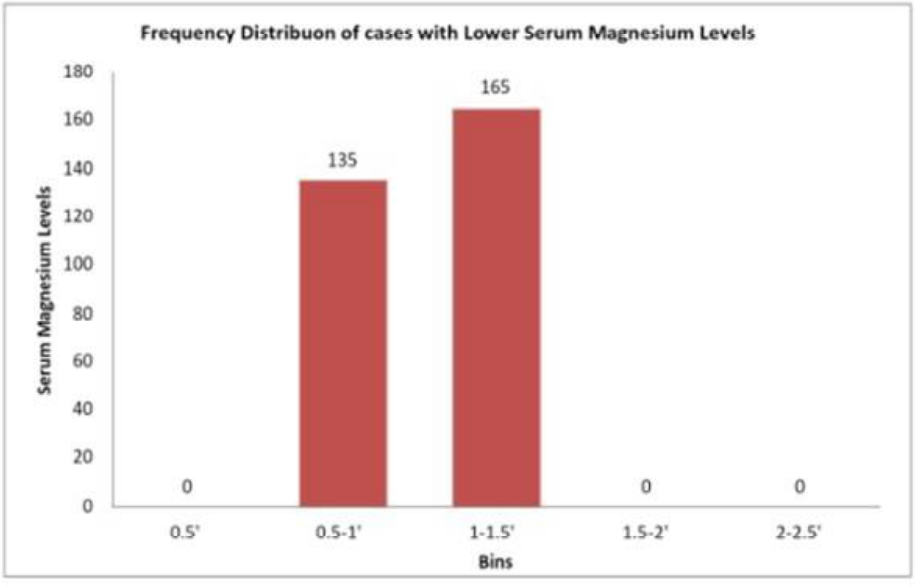


Figure 9: Fluctuations in Normal Serum Magnesium Levels

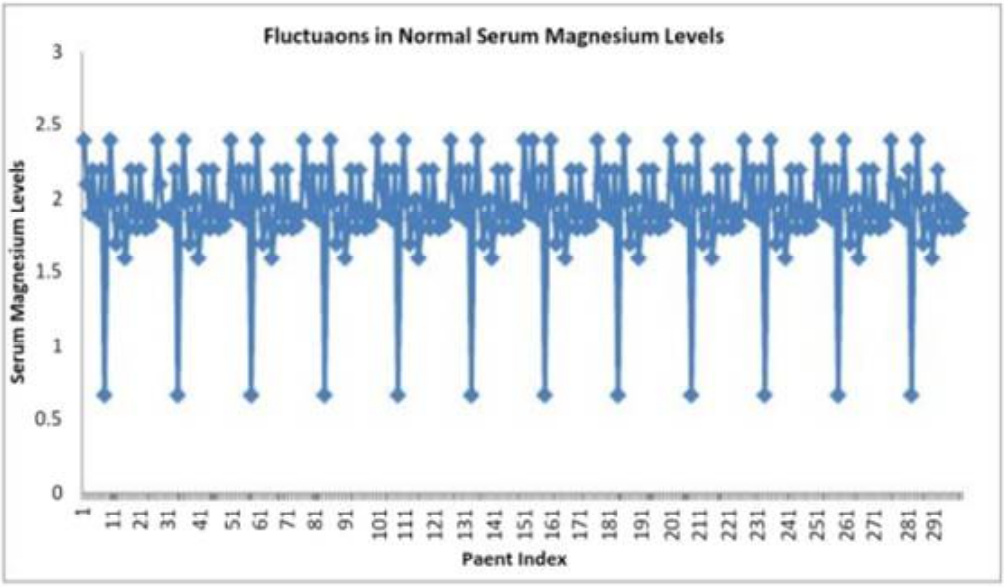
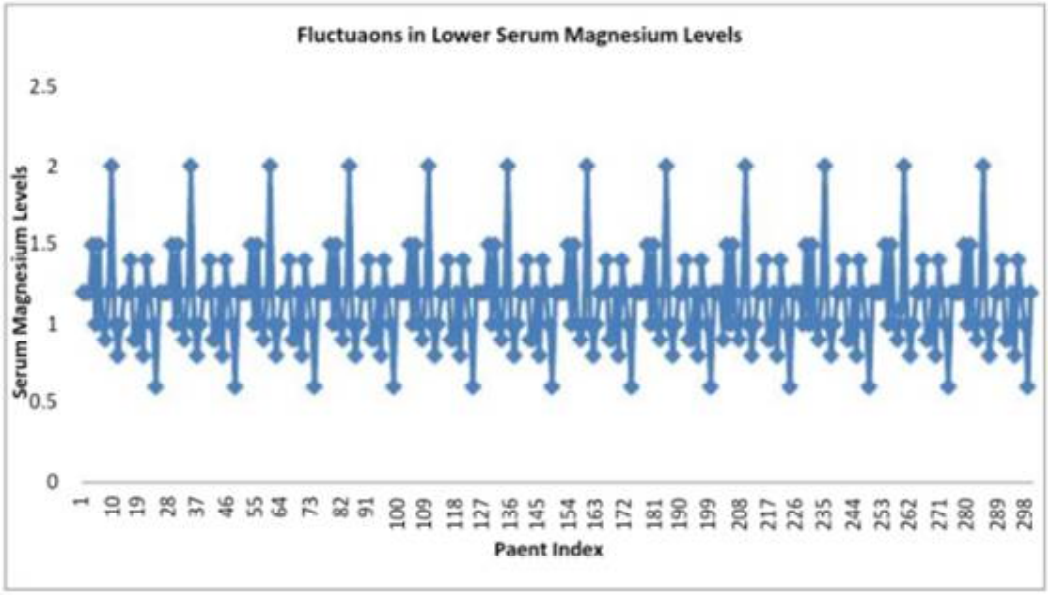


Figure 10: Fluctuations in Lower Serum Magnesium Levels



compared with the normal cases. It is clear that the Serum Magnesium levels are lower and vary in an erratic fashion in low serum magnesium cases than in the normal serum magnesium cases.

CONCLUSION

Hypertensive disorders of pregnancy is one of the major causes of maternal and fetal morbidity and mortality. It forms a member of the deadly triad, along with hemorrhage and infection. Yet as long as its etiopathogenesis is unclear, prophylaxis will be uncertain. Though the prevention is difficult, maternal and fetal morbidity and mortality can be reduced to a greater extent by early recognition and timely management.

Pregnancy is associated with physiological decrease in the concentration of elements like calcium and magnesium which is further aggravated in conditions like preeclampsia. As the severity of preeclampsia increases, more and more reduction in the levels of magnesium is seen in maternal blood.

REFERENCES

1. Purohit A *et al.* Serum magnesium status in preeclampsia. Int J Med Sci Edu. Jan-Mar 2016; 3(1): 1-6.

2. Manjareeka M, Nanda S. Serum Electrolyte levels in preeclamptic women: A comparative study. Int J Phar Bio Sci. Apr-June 2012; 3(2): 572-78.
3. Sulthana R, Singh K R, Joshi V. Role of serum calcium level in pregnancy induced hypertension. Sch.J. App. Med. Sci. 2016; 4(3B): 771-73.
4. Baruah K *et al.* A comparative study of the serum calcium level in normal pregnant and preeclamptic women attending Gauhati Medical College and Hospital. Int J Bio Med Adv Res. 2015; 6(11): 776-79.
5. Feng X. The relationship between serum calcium level and women with pregnancy induced hypertension in China: A meta-analysis. Int J Clin Exp Med. 2016; 9(1): 195-98.
6. Bucher H C *et al.* Effect of calcium supplementation on pregnancy induced hypertension and preeclampsia.A meta-analysis of randomised controlled trials. JAMA. Apr 1996; 275(14): 1113-1117.
7. Bai S T, Rudrappa G, Javarappa D. Global J Med Res. 2014; 14(4): 1-3.
8. P J Nalin. Magnesium metabolism: a brief review.Annals of the royal college of surgeons of England. 1976; 58:309-14.
9. Ghosh A K, Joshi R S. Disorders of Calcium, Phosphorous and Magnesium Metabolism. JAPI. 2008; 56:613-21.
10. Baker S B, Worthley L I G. The Essentials of Calcium, Magnesium and Phosphate Metabolism: Part I. Physiology. Critical care and resuscitation. 2002; 4:301-06.
11. Renkema K Y *et al.* Calcium and Phosphate homeostasis: Concerted interplay of new regulators. Annals of medicine. 2008; 40:82-91.
12. Kleeman R C. The Clinical Physiology of Calcium Homeostasis, Parathyroid Hormone, and Calcitonin Part I.The western J of med. 1971; 114(3): 16-43.
13. Guyton and Hall. Textbook of Medical Physiology. Twelfth edition.
14. Carl A. Burtis, Edward R Ashwood, David E. Burns. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. 4th edition.
15. Guyton and Hall. Textbook of Medical Physiology. Twelfth edition.
16. Carl A. Burtis, Edward R Ashwood, David E. Burns. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. 4th edition.
17. NP Khawaja, A Parveen, U HHussain, B Zahid *et al.* Frequency and obstetric outcome of Hypertensive disorders of pregnancy. PJMHSonline.com.2003.
18. Nadkarni J, Bahl J, Parekh P. Perinatal outcome in pregnancy associated hypertension. Indian Paediatrics. 2001; 38: 174-8.
19. S R Savita *et al.* Maternal and Perinatal Outcome in severe preeclampsia and eclampsia. JSAFOG. 2009; 1(3): 25-8.
20. O Abiodun, O O Adekunle, S I Aliyu. Serum levels of calcium and magnesium in preeclamptic- eclamptic patients in a tertiary institution. It. J. Gynaecol. Obstet. 2015; 27(3): 101-10.
21. Belizan J M *et al.* Calcium supplementation to prevent hypertensive disorders of pregnancy. N English J Med. 1991; 325(20): 1399-405.
22. Onyegbule O A *et al.* Comparison of serum levels of calcium and magnesium among preeclamptic and normotensive pregnant women at Nnamdi Azikiwe University Teaching Hospital, Nnewi, Nigeria. Into J Res Med Sci. May 2014; 2(2): 404-408.
23. Chaurasia P P, Jadav P A, Jasani J H. Changes in serum calcium and serum magnesium level in preeclamptic Vs normal pregnancy. IJBAR. 2012; 3(6): 511-13.
24. Vafaei H, Dalili M, Hashemi S A. Serum concentration of calcium magnesium and zinc in normotensive versus preeclampsia pregnant women: A descriptive study in women of Kerman province of Iran. Iran J Reproduction Med. Jan 2015; 13(1): 23-6.
25. Samar N E. Case control study of risk factors associated with preeclampsia in the Gaza Strip. J. Med. Med. Sci. Dec. 2015; 6(9): 229-33.
26. Kirsten D, Deborah H. Risk factors for preeclampsia at antenatal booking: systematic review of controlled studies. BMJ. 2005; 1-7.

APPENDIX

CMJ UNIVERSITY
Established by an act of Government of Meghalaya as per section 2(f) of UGC act 1956

CMJU/CW/Ph.D/2019 DATED: 29.03.19

To,

Mr/Ms: CHAITALI MONDAL

Registration No: 80189418100039

Sub: - Ph. D Coursework Completion & Synopsis Approval

Sir/Madam

As Per the Ph. D Course Work Examination (held during the month of Feb - 2019, Result, we are glad to inform you that you have completed the Course Work successfully and passed the examination. Your synopsis and Topic "THE ASSOCIATION BETWEEN DIETRY FACTOR OF LOW LEVEL MAGNESIUM AND DEVELOPMENT OF PRE-ECLAMPSIA AND ECLAMPSIA" has been approved by the Guide & University in RDC.

You are hereby directed to start research work and prepare thesis under the supervision of your authorized guide Dr. DIPAK DAS , as per address mentioned in your synopsis.

Wishing you all the best.

Sr. Dy. Registrar
CMJ University

CMJ UNIVERSITY CAMPUS JORABAT MEGHALAYA

CMJ UNIVERSITY

COPY TO:

1. The H.O.D Faculty of Technology / Commerce & Management / Arts/ Applied Science, CMJ UNIVERSITY
2. P.S to the V.C, CMJU
3. Copy to Guide

G.S. Road, Jorabat-793101, Ri-Bhoi Dist. (Meghalaya), Phone No.: 0361-2897413/6003205262/8799771891
Email : info@cmjumeghalaya.edu.in, Website : www.cmjumeghalaya.edu.in