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Original research article

A comparative study of serum magnesium levels in patients with and without preeclampsia in tertiary care hospital

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Abstract

Aims and Objectives: To study the levels of serum magnesium in patients with preeclampsia and patients without preeclampsia in pregnant women with over 28 weeks of gestational age in order to assess the role of magnesium in etiopathogenesis of preeclampsia; To measure the levels of serum magnesium in patients with preeclampsia; To compare it with serum magnesium levels in normotensive pregnant patients after 28 weeks of gestational age; To evaluate relationship between preeclampsia and serum magnesium levels.

Methods: The biochemistry department at Osmania General Hospital and Osmania Medical College in Hyderabad conducted case control research using a clinical and investigative approach over a 24-month period with 100 participants. Pregnant women receiving routine prenatal care at the Modern Government Maternity Hospital in Petlaburj, Hyderabad, Telangana, India.

Results: The results of our investigation showed that serum magnesium levels are considerably lower in pre-eclamptic women. Other authors' studies also produced results that were comparable. As a result, pre-eclamptic women had lower magnesium levels. Understanding the pathophysiology of preeclampsia and developing methods for its early identification, prevention, and treatment may benefit from this link.

Conclusion: Magnesium levels were decreased in pre-eclamptic women. Understanding the pathophysiology of preeclampsia and developing methods for its early identification, prevention, and treatment may benefit from this link.

Keywords: preeclampsia, magnesium levels, gestational age, pregnant women

Introduction

Pregnancy-related hypertensive problems are frequent and constitute one of the major causes of maternal fatalities, along with haemorrhage and infection (the "great triad") [1]. One of the most significant and fascinating unresolved issues in obstetrics is hypertensive diseases. 5 to 10 percent [2] of all pregnancies and 4 to 18 percent [3-5] in developing nations are complicated by these illnesses. The incidence of preeclampsia in India is reportedly between 8 and 10 percent, according to the national health portal of the Indian government. Hypertensive illnesses were responsible for 16% of maternal fatalities in wealthy nations [6]. Approximately 15% of preterm births are caused by preeclampsia, and pre eclampsia is also responsible with 12 to 25% of foetal growth restrictions [7].

Preeclampsia is a progressive, multisystem disorder that appears after 20 weeks of pregnancy and is characterised by high blood pressure of at least 140/90 mm Hg, proteinuria, and/or end-organ dysfunction (including renal dysfunction, liver dysfunction, central nervous system disturbances, pulmonary oedema and thrombocytopenia). It is one of the most frequent pregnancy problems and the main global cause of maternal and foetal morbidity and mortality [8]. Despite years of ongoing research, the precise cause of this illness is still unknown. Preeclampsia (PE) is a multifactorial illness caused by an intricate interplay of several pathogenetic variables, like genetic, immunogenic, or environmental factors.

Preeclampsia in pregnancy is caused by a pathophysiological mechanism that is characterised by trophoblastic invasion of the spiral arteries failing, which results in maladaptation of maternal spiral arterioles and may be linked to increased vascular resistance of the uterine artery and decreased placenta perfusion [2].

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Women in the reproductive age group frequently lack both macro- and micronutrients, particularly in poor nations. According to epidemiological and biological data, severe maternal and foetal morbidity can be caused by acute or chronic particular dietary deficits. The findings of numerous clinical research demonstrate the connection between the worsening of the hypertension complication and the alteration in chemical concentrations in mother's serum [6].

Magnesium is crucial for peripheral vasodilation and neurochemical transmission [9, 10]. Magnesium affects blood pressure by modifying vascular tone and structure through its effects on numerous metabolic processes that regulate vascular differentiation, development, and apoptosis [11]. A lack of this mineral has also been linked to hyperglycemia, insulin resistance, endothelial dysfunction, pro-inflammatory state, oxidative stress, and platelet aggregation [12]. Magnesium shortage can also affect foetal development and lead to preterm labour [13]. As a result, magnesium may play a physiological role in controlling blood pressure, and variations in its levels may play a role in the etiopathogenesis of hypertension and, ultimately, preeclampsia.

In order to analyse and compare the levels of magnesium in the maternal serum of patients with preeclampsia and in healthy pregnant women, as well as to assess their contribution to preeclampsia, this study was undertaken. This study may be beneficial in determining the value of consistently checking the serum magnesium levels to identify patients who are more likely to develop preeclampsia early on. It may also be useful in determining the benefits of preventive magnesium supplementation.

Materials and Methods

The biochemistry department at Osmania General Hospital and Osmania Medical College in Hyderabad conducted case control research using a clinical and investigative approach over a 24-month period with 100 participants. Pregnant women receiving routine prenatal care at the Modern Government Maternity Hospital in Petlaburj, Hyderabad, Telangana, India.

Inclusion Criteria:

- Singleton pregnancy.
- Age group of 20 to 35 years.
- Gestational age of 28 weeks to 40 weeks.

Cases: Patients diagnosed with preeclampsia and eclampsia.
Controls: Normotensive pregnant women.

Exclusion criteria

- Patient's age <20 years and >35 years.
- Gestational age < 28 weeks and > 40 weeks.
- Patients with chronic hypertension.
- Multifetal pregnancy.
- Patients with other co morbid conditions like pre-existing or gestational diabetes mellitus, anaemia, chronic infections, renal disorders, cardiac disorders.
- Patients with HELLP syndrome, intrauterine foetal death, abruptio, oligohydramnios.

Methodology

i) Patients were explained about the study and informed consent was taken.
ii) Detailed clinical history along with demographic data was taken as per the case sheet proforma.
iii) Clinical examination was done.
iv) Height and weight during the first trimester which was noted in antenatal OP card was taken and BMI was calculated as per the formula.
v) The blood pressure was measured by the sphygmomanometer while the patient was lying on a couch on her side. The reading should be 140/90 mmHg and above which was repeated four hours apart.
vi) To diagnose proteinuria, 2 midstream samples of urine collected at least 4 hours apart showing albumin "+" or more using reagent strips or dipstick.
vii) Urinary tract infection was excluded by routine urine analyses.
viii) Preeclampsia is defined as a blood pressure of at least 140/90 mmHg measured on two occasions each 4 hours apart, accompanied by proteinuria of at least 300 mg per 24 hours, or at least 1+ on dipstick testing.
ix) Severe preeclampsia is defined as having one or more of the following criteria:
a) Blood pressure of at least 160/110 mmHg.
b) Proteinuria of at least 5 g per 24 h, or at least 3+ on dipstick testing, oliguria of less than 500 ml per 24 h.
c) Cerebral or visual disturbances.
d) Epigastric or right upper quadrant pain.
e) Impaired liver function.

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f) Thrombocytopenia.
g) Fetal growth restriction.
x) The venous blood sample was drawn at the diagnosis of preeclampsia, and if the patient had imminent symptoms before the administration of magnesium sulfate in study group and in control group above 28 weeks of gestational age, randomly in the third trimester during their visit to the hospital for antenatal checkups.
xi) Blood was drawn from the antecubital vein using a sterile needle and syringe into plain vacutainer tube. The samples in plain tubes were allowed to clot undisturbed at the room temperature and then centrifugation for 10 min at 4000 rpm into plain tubes and stored at -20 °C until time of analysis.
xii) Serum magnesium levels were measured using semi auto analyzer spectrophotometrically.
xiii) All findings were recorded, tabulated in MS excel and statistically analyzed using, unpaired student t-test, and expressed in terms of mean, standard deviation and p value was calculated. Serum magnesium levels were correlated with systolic and diastolic blood pressure using correlation test.
xiv) A p value <0.05 was considered to be statistically significant.

Serum magnesium level estimation

Methodology

In this magnesium process, calcium interference is removed by glycoletherdiamine-N,N,N',N'-tetraacetic acid (GEDTA), and magnesium forms a coloured complex with xylidyl blue in a strongly basic solution. The colour generated is proportional to the magnesium content and is monitored bichromatically at 520/800 nm.

$$Mg2+ + \text{Xylidyl blue} \xrightarrow{\text{PH 11.4}} \text{Purple complex}$$

In mg/dL at 37 °C, automatically printed for each sample. The value must be multiplied by 0.4114 in SI units (mmol/L).

Expected Values

Serum: 1.9 - 2.7 mg/dl.

Urine: 24 - 255 mg/24 hours.

Results

The current study was conducted at the Osmania Medical College's Department of Biochemistry and the Modern Government Maternity Hospital's Obstetrics and Gynaecology Department in Petlaburj, Hyderabad.

The study involved a total of 100 participants, of which 50 were pregnant women with normotension (Group 1) and 50 had preeclampsia (Group 2).

Age

Parameter	Cases [mean ± SD]	Controls [mean ± SD]	'p' value	Significance
Age (years)	23.96+1.41	23.6+2.84	0.42	Not significant

The age of the controls was 23.6 years and that of the patients was 23.96 years [mean SD]. Between the two groups, there was no statistically significant age difference.

Gestational Age

Parameter	Cases [Mean ± SD]	Controls [Mean ± SD]	'p' value	Significance
Gestational Age (weeks of gestation)	34.12±6.36	35.76±2.76	0.09	Not Significant

The gestational ages of the cases were 34.126.36 weeks and the controls were 35.762.76 weeks (mean SD). Between the two groups, there was no statistically significant difference in gestational age.

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Gravidity

Parameters	Cases [Mean ± SD]	Controls [Mean ± SD]	'p' value	Significance
Gravidity	2.1± 0.7	2.06± 1.09	0.82	Not Significant

The cases' [mean SD] gravidity was 2.17, while that of the controls was 2.06 1.09. Between the two groups, there was no statistically significant difference in gravidity.

Body Mass Index [BMI]

Parameters	Cases [Mean ± SD]	Controls [Mean ± SD]	'p' value	Significance
BMI (kg/m2)	25.73± 4.6	25.51± 5.17	0.84	Not Significant

The [mean SD] BMI of the patients was 25.73 4.6 kg/m2, whereas it was 25.51 5.17 kg/m2 for the controls. Between the two groups, there was no statistically significant difference in BMI.

Systolic blood pressure

Parameter	Cases (Mean ±SD)	Controls (Mean ±SD)	'p' value	Significance
Systolic blood pressure	149.7 ± 3.53	110.8 ± 6.96	0.001	High

Systolic blood pressure was [mean SD] 149.7 3.53 mm Hg in patients and 110.6 6.96 mm Hg in controls. Between the two groups, there is a significant statistical difference in systolic blood pressure.

Diastolic Blood Pressure

Parameter	Cases (Mean ± SD)	Controls (Mean ± SD)	'p' value	significance
Diastolic blood pressure	98.6 ±3.53	72.6 ± 6.94	0.001	High

Diastolic blood pressure was [mean SD] at 98.6 3.53 mm Hg in patients and 72.6 6.94 mm Hg in controls. The diastolic blood pressure in the two groups differs significantly statistically.

Mean Arterial Pressure

Parameter	Cases (Mean ±SD)	Controls (Mean ±SD)	'p' value	Significance
Mean arterial pressure	115.8 ± 1.41	85.1 ± 6.43	0.001	High

In cases, the [mean SD] mean arterial pressure was 115.8 1.41 mm Hg, compared to 85.1 6.43 mm Hg in controls. The mean arterial pressure differs significantly statistically between the two groups.

Urine albumin

Albumin (proteinuria) varies from 1+ to 3+ in the urine of every individual in the study group, while albumin (1+) (proteinuria) was only found in one patient's urine in the control group.

Hemoglobin levels

Parameter	Cases (Mean ±SD)	Controls (Mean ± SD)	'p' value	Significance
Hemoglobin (g/dl)	10.7 ±2.12	10.9± 1.2	0.64	Not Significant

Haemoglobin levels were 10.7 2.12 g/dl in cases and 10.9 1.2 g/dl in controls (mean SD). Between the two groups, there is no statistically significant difference in haemoglobin levels.

Platelet count

Parameter	Cases (Mean ±SD)	Controls (Mean ± SD)	't' value	'p' value	Significance
Platelet count (cells/mm3)	2.49 ±0.49	2.49± 0.71	5.906	0.87	Not Significant

The [mean SD] Platelet counts were 2.49 0.49 cells/mm3 in patients and 2.49 0.71 cells/mm3 in controls. Between the two groups, there is no statistically significant change in platelet count.

Blood Urea

Parameter	Cases (Mean ± SD)	Controls (Mean ± SD)	'p' value	Significance
Blood urea (mg/dl)	21.2 ±4.57	21.08± 2.76	0.79	Not significant

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Blood urea levels in patients were 21.2 4.57 mg/dl on average, while they were 21.08 2.76 mg/dl in controls. The levels of blood urea between the two groups do not differ statistically.

Serum creatinine

Parameter	Cases (Mean ±SD)	Controls (Mean ± SD)	'p' value	Significance
Serum creatinine (mg/dl)	0.78 ±0.26	0.51± 0.16	0.001	High

The [mean SD] serum magnesium levels were 0.78 0.26 mg/dl in patients and 0.51 0.16 mg/dl in controls. Between the two groups, there is a significant statistical difference in the serum magnesium levels.

Serum bilirubin

Parameter	Cases (Mean ± SD)	Controls (Mean ± SD)	'p' value	Significance
Serum bilirubin (mg/dl)	0.90 ±0.59	0.78± 0.53	0.28	Not Significant

The [mean SD] blood bilirubin levels were 0.90 0.59 mg/ dl in patients and 0.78 0.53 mg/ dl in controls. The levels of serum bilirubin in the two groups do not differ statistically.

Serum Magnesium

Parameter	Cases (Mean ± SD)	Controls (Mean ± SD)	'p' value	Significance
Magnesium (mg/dl)	1.63 ±0.31	1.99± 0.27	0.001	High

The [mean SD] serum magnesium levels were 1.63 0.31 mg/ dl in patients and 1.99 0.27 mg/ dl in controls. Between the two groups, there is a significant statistical difference in the serum magnesium levels.

Serum calcium

Parameter	Cases (Mean ± SD)	Controls (Mean ± SD)	'p' value	Significance
Calcium (mg/dl)	8.09 ±0.35	8.49 ± 1.28	0.03	High

The [mean ± SD] serum calcium levels in cases was 8.09±0.35mg/ dl and in controls 8.49±1.28 mg/dl. There is a high statistical difference in the serum calcium levels between the two groups.

Random blood sugar

Parameter	Cases (Mean ± SD)	Controls (Mean ± SD)	'p' value	Significance
Random blood sugar (mg/dl)	79.6 ±1.41	77.5± 5.88	0.01	High

Random blood sugar levels were [mean SD] 79.61.41mg/dl in cases and 77.55.88mg/dl in controls. Random blood sugar values show a significant statistical difference between the two groups.

Serum magnesium

The correlation of serum magnesium levels with Systolic blood pressure, Serum magnesium with Diastolic blood pressure is represented in the following table and graph.

There is a negative correlation between

- Serum magnesium and systolic blood pressure (r: - 0.81).
- Serum magnesium and diastolic blood pressure (r: -0.67).

Correlation of serum magnesium with different parameters

Parameter	'r' value	'p' value	Correlation
Systolic blood pressure (mmHg)	-0.81	<0.001	High
Diastolic blood pressure (mmHg)	-0.67	<0.001	High

r-Karl Pearson correlation Co-efficient

Discussion

This study was conducted to evaluate the changes in serum magnesium levels, in preeclamptic women, in 2nd and 3rd trimester of pregnancy and similar parameters were studied in normal pregnancy in both trimesters. The results were analyzed and compared.

1. **Age:** preeclampsia is more common in extremes of age i.e. in young ladies and in ladies above age

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of 35 years, and in the later group it is the superimposed preeclampsia over chronic hypertension. In our study the mean age of cases was 23.96±1.41 and of controls 23.6±2.84. There was statistically no significant difference between the study and control group with respect to the age [1, 2, 9, 14, 15].

2. **Gestational age:** The [mean ± SD] gestational age of the cases was 34.12±0.09 weeks and of the controls 35.76± 2.76 weeks. Gestational age influences the perinatal outcome. There was statistically no significant difference between the study and control group with respect to the gestational age [1, 9, 14].
3. **Gravidity:** Preeclampsia is more common in primigravida. The [mean ± SD] gravidity of the cases was 2.1±0.7 weeks and of the controls 2.06± 1.09.There was statistically no significant difference between the study and control group with respect to the gravidity [1, 2, 9, 14].
4. **Body mass index:** The [mean ±SD] BMI of the cases was 25.73± 4.66kg/m2 and of the controls 25.51± 5.17kg/m2. There was statistically no significant difference between the study and control group with respect to the body mass index. However, women with a greater BMI in pregnancy are more likely to become hypertensive than those with lower BMI [1, 9, 14, 15].
5. **Blood Pressure:** The mean systolic blood pressure in normal pregnant women (controls) is 110.8mmHg and in pre-eclamptic women it is 149.7mmHg. The mean diastolic blood pressure in controls is 72.6mmHg and in cases it is 98.6mmHg and mean arterial pressure in controls is 85.1mm Hg, whereas it is 115.8mm Hg in cases of preeclampsia.

Comparison of blood pressure

Authors	Systolic BP(mm of hg) Diastolic BP (mm of hg)	Systolic BP (mm of hg) Diastolic BP (mm of hg)	P value
	CASE S	CONTROLS	
Chanvitya *et al.*	144.5 ± 3.9	110.4 ± 6.4	<0.001
	93.0 ± 2.9	73.3 ± 6.6	
Sukopan *et al.*	156±13.1	111±7.0	<0.01
	98.3±16.3	71.3±6.0	
Idougoun *et al.*	165.45 ± 30.45	112.61 ± 10.10	<0.001
	108.18 ± 20.89	68.69 ± 6.26	
Naser *et al.*	171.20 + 20.88	111.20 + 6.39	<0.001
	104.80 + 10.84	75.33 + 5.16	
Present study	149.7 ± 3.53	115.8 ±1.41	<0.001
	98.6 ±3.53	85.1 ± 6.43	

There is a highly significant statistical difference in the mean blood pressure values (p<0.001). The raised blood pressure (systolic and diastolic) in pre- eclampsia is due to maternal endothelial cell activation/endothelial dysfunction which is due to release of placental anti-angiogenic factors and other multiple factors in plasma 3, 20. The findings of our study correlate well with the studies done by other authors [1, 9, 56, 15, 16].

6. **Proteinuria /urine albumin:** only one women in the control had proteinuria of 1+ on urine dipstick method but with normal blood pressure recordings whereas all the pre-eclamptic women had the presence of albumin/protein in the urine ranging from 1+ to 3+. This may be due to glomerular endothelial injury which increases the permeability for albumin.2
7. **Hemoglobin:** The [mean ± SD] hemoglobin levels of the cases was 10.74±2.12 g/dl and of the controls 10.9± 1.2 g/dl. There was statistically no significant difference between the study and control group with respect to the hemoglobin [1, 9, 14].
8. **Platelet count:** The [mean ± SD] platelet count of the cases was 2.49±0.87cells/mm3 and of the controls 2.49±0.71cells/mm3.There was statistically no significant difference between the study and control group with respect to the platelet count [1, 9].
9. **Blood urea:** The [mean ± SD] blood urea of the cases was 21.28±4.57 mg/dl and of the controls 21.08± 2.76mg/dl. There was statistically no significant difference between the study and control group with respect to the blood urea [1, 9, 14].
10. **Serum creatinine:** The [mean ± SD] serum creatinine of the cases was 0.78±0.26mg/dl and of the controls 0.51± 0.16mg/dl. There was statistical significant difference between the study and control group with respect to the serum creatinine.
11. **Serum bilirubin:** The [mean ± SD] serum bilirubin of the cases was 0.90±0.59mg/dl and of the controls 0.78±0.53mg/dl. There was statistically no significant difference between the study and control group with respect to the serum bilirubin.

The study done by makuyana *et al.*, there was no significant difference in serum bilirubin in the two groups, but, there was significant statistical difference in the serum creatinine levels between the normotensive and pre eclamptic group [17].

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12. **Serum magnesium:** The mean value of serum magnesium levels in controls is 1.99±0.27 mg/dl which is within the range of 1.7-2.2 mg/dl [18-20]. The mean value of serum magnesium levels in cases is 1.63±0.31 mg/dl.

The results of the present study show that there is statistically significant difference between the two groups and the mean serum magnesium level in preeclampsia was lower than in normal pregnancy.

Comparison of serum magnesium levels

Authors	Cases	Controls	P value
Fatemeh *et al*.,	1.92±0.37 mg/dl	2.29±0.69 mg/dl	<0.01
Zohreh *et al*.,	1.72±0.38 mg/dl	2.2±0.63 mg/dl	0.006
Golmohammad *et al*.,	1.90±0.24 mg/dl	1.90±0.26 mg/dl	>0.05
Chanvitya *et al*.,	2.04+0.19 mg/dl	2.04+0.21 mg/dl	>0.05
Chandra *et al*.,	0.61±0.12 mmol/l	0.92±0.28 mmol/l	0.008
Akinloye *et al*.,	1.1±0.36 mg/dl	1.8±0.32 mg/dl	<0.001
Sukonpan *et al*.,	1.6±0.14 mg/dl	2.1±0.16 mg/dl	< 0.001
Sanders *et al*.,	2.33±0.10 mg/dl	1.64±0.2 mg/dl	>0.05
Idogun *et al*.,	1.5 ± 0.28 mg/dl	1.55±0.32 mg/dl	>0.05
Seema *et al*.,	1.6±0.2 mg/dl	1.9±0.23 mg/dl	<0.001
Present study	1.63±0.31 mg/dl	1.99±0.27 mg/dl	<0.001

Our data support the hypothesis that magnesium deficiency is seen in the case of preeclampsia. Recent studies report a relationship between hypomagnesemia and pregnancy induced hypertension [14, 16, 21-24]. Although the explanation for this result is not clear, they propose that magnesium promotes vascular muscle relaxation.

Magnesium has established its role in obstetrics with its relationship to both fetal and maternal wellbeing. The low concentration of magnesium in serum exposes the women to a risk of pregnancy related complications which includes pre-eclampsia. This is usually due to a defect in enzymatic processes where magnesium acts as a cofactor which would be affected by decreased serum magnesium levels. The success of magnesium therapy in the treatment for eclamptic seizures and it known effect on vascular responses *in vitro* suggest that magnesium might be deficient in women with pre-eclampsia [18, 19, 25, 26]. But, this result is contradictory to some studies which report that the mean serum magnesium level in preeclampsia is not different from that of normal pregnancy [27, 15, 22]. Some studies show that serum magnesium is even higher in the pre-eclamptic group than in normal pregnancy [28]. The difference may be explained by the variation of the study population and the dietary intake.

13. **Serum calcium:** The mean value of serum calcium in controls is 9.7±0.7 which is within (9.5-11.1 mg/dl) given by previous studies. The results of the present study show that there is stastically significant difference between the two groups and calcium levels were lower in patient with preeclampsia than that of the normal pregnant ladies.

Comparison of serum calcium

Authors	Cases	Controls	P value
Sukonpan *et al*.,	9.0 ± 0.4 mg/dl	9.7 0.7± mg/dl	< 0.0001
Fatemeh *et al*.,	9.1±0.75mg/dl	9.47±1.58 mg/dl	>0.05
Suleyman *et al*.,	8.6±0.5 mg/dl	9.4±0.72 mg/dl	<0.001
Naser *et al*.,	8.22 ±0.12 mg/dl	9.50± 0.16 mg%	<0.001
Golmohammad *et al*.,	8.70±0.58 mg/dl	8.97±0.49 mg/dl	>0.05
Chanvitya *et al*.,	8.70 ±0.59mg/dl	8.99± 0.31 mg/dl	>0.05
Soe Min *et al*.,	8.8±0.7 mg/dl	9.8±0.9 mg/dl	<0.001
Idougon *et al*.,	9.2±1.02 mg/dl	9.8±0.87 mg/dl	<0.001
Seema *et al*.,	8.3±0.13 mg/dl	9.6±0.18 mg/dl	<0.001
Present study	8.09±0.35 mg/dl	8.49±1.28 mg/dl	0.03

This study's cases had serum calcium levels that were comparable to those reported by Naser *et al*., Idougon *et al*., Soe Min and Sulamin *et al*. [1, 27, 16, 29, 21, 23, 24, 30].

The information supported the theory that calcium may play a role in the onset of preeclampsia. The level of intracellular calcium concentration may be able to explain how serum calcium affects blood pressure. When serum calcium decreased, the concentration of intracellular calcium increased, which caused the smooth muscles in blood arteries to tighten, increasing vascular resistance [16, 31, 32]. This, however, runs counter to certain research that found no differences between normal pregnancy and

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preeclampsia in terms of the mean serum calcium level [9, 15, 22]. The failure to distinguish between underlying chronic hypertension or renal disease and preeclamptic condition during pregnancy, as well as the disparity in dietary intake and the timing of sample collection, may be to blame for the negative findings of the other research. Different populations included in the studies may be the cause of the variations in serum calcium values seen in those studies.

14. **Random blood sugars:** The [mean ± SD] random blood sugars of the cases was 79.66±1.41 and of the controls 77.5± 5.88. There was statistically significant difference between the study and control group with respect to the random blood sugars.

Correlation of severity

Magnesium with blood pressure: The present study shows that with the increase in systolic blood pressure and diastolic blood pressure, there is a decrease in the serum magnesium levels. The correlation coefficient of the present study is comparable to that of the study done by Jafrin *et al*., and Akinloye *et al*. The serum magnesium levels fall as the severity of the disease increases [14, 18].

Conclusion

Pre-eclampsia is a pregnancy specific disorder of unknown etiology accounting for 14% of maternal deaths worldwide. Incidence of this disorder is around 8-10%. The high incidence of pre-eclampsia in developing countries, has forced some authors to conclude that malnutrition is a risk factor in the etiology of pre-eclampsia. The results of many clinical studies show the relationship between the aggravation of the hypertensive complication and the change in concentration of various chemicals in mother's serum. Interestingly, variable serum magnesium levels are found in pre-eclamptic mothers.

In order to determine whether the levels of this element had changed, a study was carried out in our hospital. In the third trimester of pregnancy, the serum magnesium levels of 50 pre-eclamptic women were measured and compared with those of 50 healthy pregnant women.

Our study's findings demonstrated that pre-eclamptic women have significantly lower serum magnesium levels. Studies carried out by other writers yielded findings that were comparable. Therefore, the magnesium levels in pre-eclamptic women were lower. This connection could be important for understanding the pathophysiology of preeclampsia and for formulating strategies for early detection, prevention and treatment.

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Conflict of interest: None.

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