Evaluation of Serum Magnesium Level and Maternal Outcomes in Antenatal Women

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Abstract

Background: Magnesium is one of the essential minerals which has multiple biochemical functions. Magnesium deficiency during pregnancy can lead to adverse outcomes like preterm birth, pre-eclampsia, intra-uterine growth retardation (IUGR), and adverse neurodevelopmental outcomes. Aim and Objectives: The present study was undertaken to determine serum magnesium levels in antenatal women and evaluate maternal outcomes namely, preeclampsia and preterm birth. Material and Method: The study was prospective, observational and Cross-sectional which included 220 pregnant women attending outpatient department for antenatal care. Serum magnesium levels were determined at 24-26 weeks of pregnancy and were divided into Group 1 women with low magnesium levels and Group 2 with normal magnesium levels. Maternal outcomes of both Group 1 and Group 2 were studied after 10 weeks or at the time of delivery, whichever was earlier.

Result: Serum magnesium levels in antenatal women were 1.79 ± 0.16 mg/dl (Mean \pm SD). The prevalence of magnesium deficiency in antenatal women was 6.8%. In Group I, out of 15 women with hypomagnesemia (<1.6 mg/dl), 3 women developed preeclampsia and none of them had preterm labour. In Group II, out of 205 women with normal magnesium (>1.6 mg/dl), 39 women developed preeclampsia whereas 35 women had preterm labour. **Conclusion:** Serum Magnesium levels needs to be evaluated in all antenatal women and may predict maternal outcomes.

Key Words

Magnesium, Preeclampsia, Preterm labour

Introduction

Magnesium is one of the important minerals and it has diverse functions in our body. The significance of magnesium during pregnancy is that it essential for both mother and growing fetus. It is a cofactor for numerous enzymes, crucial for bone formation, regulating vascular tone, muscular contraction, and neurological function.

The prevalence of magnesium deficiency reported in the general population is up to 15%^[1] whereas during

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Correspondence to: Lalna R. Takale, Department of Biochemistry, Bharati Vidyapeeth (Deemed to be) University Medical College, Pune, India. Manuscript Received: 25.06.2024; Revision Accepted: 30.08.2024; Published Online First: 10 April, 2025 Open Access at: https://journal.jkscience.org pregnancy it is reported to be $43.6\%^{[2]}$ in the rural population and 40% in the urban population^[3].

Magnesium deficiency in pregnant women can occur due to inadequate dietary intake, increased requirements for fetal development, or physiological hemodilution that occurs in pregnancy^{[4].}

Adverse pregnancy outcomes like preterm labour, preeclampsia, intra-uterine growth retardation (IUGR), and

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adverse neurodevelopmental outcomes may occur due to magnesium deficiency during pregnancy. The symptom of leg cramps at night experienced by a pregnant woman can also be attributed to magnesium deficiency^[1]. Magnesium acts as a vasodilator due to its calcium channel blocking action and thus opposing arterial vasoconstriction of calcium. This vasodilation effect of magnesium is implicated in preventing preeclampsia^[5].

Hypomagnesemia leads to decreased magnesium in the myometrium which could result in preterm labour^[6].

Thus, deficiency of magnesium may affect maternal as well as perinatal outcome. Evaluation of magnesium levels during pregnancy may be a predictor of adverse maternal outcomes like preeclampsia and preterm labour and they may be prevented by ensuring adequate dietary intake and magnesium supplementation if necessary.

Most of the research studies done so far have found that serum magnesium levels are reduced in preeclamptic women^[7]. A few studies have also reported normal magnesium levels in pre-eclampsia. Thus, the results of serum magnesium levels in pre-eclampsia are inconclusive. Similarly, studies have also found low serum magnesium levels in preterm labour^[8].

Antenatal care includes diagnostic test to detect anemia, gestational diabetes mellitus. Estimation of serum magnesium which is a simple and cheap investigation may help to predict pre-eclampsia and preterm labour and thus prevent these adverse outcomes. Hence, the aim of this study was to determine serum magnesium levels in antenatal women and evaluate the maternal outcomes, namely preeclampsia and preterm birth.

Material and Methods

The study was Prospective, Observational, and Crosssectional undertaken on two hundred and twenty (220) pregnant women attending the obstetric outpatient department (OPD) for antenatal care at a Tertiary Care Teaching Hospital from June 2022 to June 2023.

Sample size of 220 was calculated using prevalence of pre-eclampsia in hypomagnesemia and considering drop out of study participants.^[9]

Inclusion Criteria: Antenatal women above 18 years at 24-26 weeks of gestation.

Exclusion Criteria: Antenatal women with Twin pregnancy, history of hypertension, Renal or cardiovascular disease, Diabetes mellitus, newly diagnosed preeclampsia and women with gestational diabetes mellitus (GDM) were excluded. Antenatal women on Diuretic therapy, magnesium supplements, antacids containing magnesium (Gelusil, Mucaine gel, etc. and

Proton pump inhibitors) were also excluded.

The study was initiated after obtaining Institutional Ethical Committee approval (BVDUMC/IEC/25 dated 25/04/2022) and taking Written Informed Consent from the participants.

Demographic and Obstetric data such as Age in years, weight in kilograms, height in cm and gestational age was noted. Systolic and diastolic blood pressure in mm of Hg was measured using sphygmomanometer.

2 ml venous sample was collected by veni-puncture under all aseptic precautions in a plain vacutainer and was allowed to clot. The serum was separated by centrifugation at 3000 rpm for 15 minutes. Serum Magnesium was estimated using an Enzymatic method on Abbott Alinity Chemistry integrated platform.

After sample analysis, the subjects were divided into two groups depending on serum magnesium levels- Group 1: Antenatal women with low magnesium levels. (<1.6 mg/dl) and Group 2: Antenatal women with normal magnesium levels. (1.6-2.6 mg/dl). Maternal outcomes of both Group 1 and Group 2 were studied after 10 weeks or at the time of delivery, whichever was earlier.

Statistical Analysis: Data obtained was statistically analysed by using Statical Package for Social Science (SPSS) software version 28.0. Continuous variables were expressed as mean \pm standard deviation, logistic regression analysis was done to determine the relationship between demographic and clinical data and serum magnesiumas confounding variables in the determination of pre-eclampsia, eclampsia, severe preeclampsia) and Preterm labour.

Results

The study revealed that prevalence of magnesium deficiency in antenatal women is 6.8%. Out of these women with hypomagnesemia, preeclampsia was observed in 20% and none of them had Preterm labour. In women with normal magnesium levels, preeclampsia was observed in 21.08% and Preterm labour in 17.07%.

Table 1 shows the baseline demographic and biochemical parameters of Antenatal women.

Serum magnesium levels and maternal outcomes as shown in Table 2and Table 3, in Group 1, 2 women developed preeclampsia, 1 severe preeclampsia. On the other hand, in Group 2, 4 women developed eclampsia, 30 had preeclampsia and 9 with severe preeclampsia. The type of delivery in these 46 women, 34 women had undergone emergency caesarean section, 3 of them had elective caesarean section and 9 of them had full term

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Table	1:	Baseline	Demographic	and	Clinical
Param	ete	rs of Anter	natal Women		

N=220	Mean ± SD
Age (years)	26.90 ± 4.48
Weight (Kilograms)	60.48 ± 11.42
Height (cm)	155.13 ± 5.64
Body Mass Index (BMI)	25.10 ± 4.42
Gestational age (weeks)	25.82 ± 2.4
Systolic Blood pressure	103.74 ± 11.37
(mm of Hg)	
Diastolic Blood pressure	65.72 ± 8.81
(mm of Hg)	

Table 2: Serum Magnesium levels in Antenatalwomen with Pre-eclampsia

	Serum Magnesium levels		
	< 1.6 mg/dl	>1.6 mg/dl	
	(n=15)	(n=162)	
Preeclampsia	2	30	
Severe Preeclampsia	1	9	
Eclampsia	0	4	

Table 3: Serum Magnesium levels in Antenatalwomen with Preterm labour

	Serum Magnesium levels			
	< 1.6mg/dl	>1.6 mg/dl		
	(n=15)	(n=205)		
Preterm labour	0	35		

	Preterm (n=35)	Full term (n=185)	P value
Age	29.05 ± 4.94	26.49 ± 4.28	0.002**
BMI	24.87 ± 4.3	25.14 ± 4.45	0.741
Gestational age	25.31 ± 2.38	25.91 ± 2.4	0.176
Systolic BP	105.6 ± 12.43	103.38 ± 11.15	0.29
Diastolic BP	66.4 ± 8.33	65.59 ± 8.9	0.619
Serum Magnesium levels	1.8 ± 0.09	1.78 ± 0.17	0.499

 Table 5: Comparison of Demographic and Clinical parameters in Antenatal women with Preterm labour

normal vaginal delivery.

Preterm labour observed only in Group 2 in which 35 women developed this outcome.

Table 4 and Table 5 shows statistically significant differences in the mean and SD with respect to Age, BMI, gestational age and Diastolic BP in antenatal women with Preeclampsia whereas age is statistically significant in Preterm labour.

Discussion

Magnesium is one of the important minerals and it has diverse functions in our body. The significance of magnesium during pregnancy is that it essential for both mother and growing fetus. Deficiency of magnesium may influence maternal as well as perinatal outcome. Evaluation of magnesium levels during pregnancy may be a predictor of adverse maternal outcomes like

Table 4:	Comparison	of Demo	graphic and	Clinical	Parameters	in Antena	atal Women
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	With Preeclampsia (n=46) Mean ± SD	Without Preeclampsia (n=174) Mean ± SD	P value
Age	29.2 ± 5.14	26.2 ± 4	< 0.0001**
BMI	28.85 ± 4.12	25.17 ± 4.5	< 0.0001**
Gestational age	25.07 ± 2.12	26.01 ± 2.43	0.018*
Systolic BP	104.57 ± 16.11	103.52 ± 9.67	0.576
Diastolic BP	76.22 ± 9.45	65.33 ± 8.57	< 0.0001**
Serum Magnesium levels	1.78 ± 0.11	1.79 ± 0.18	0.72



preeclampsia and preterm labour.

Pre-eclampsia is a hypertensive disorder of pregnancy which is characterized by high blood pressure and proteinuria that appears after 20 weeks of gestation. Clinically pre-eclampsia may be defined as hypertension with blood pressure of at least 140/90 mmHg measured on two occasions each 6 hours apart, accompanied by proteinuria of at least 300 mg 24 hours, at least 1+ on dipstick testing, with or without pathological edema^[10].

Our study revealed that the prevalence of magnesium deficiency in antenatal women is 6.8%. Pathak *et al* ^[2] reported hypomagnesemia in 44% pregnant women with serum magnesium levels below 1.80 mg/dl. Kapil *et al* found that overall magnesium deficiency is observed in 4.6% of pregnant women in urban India which is slightly lower than our study^[11].

The proportion of women with pre-eclampsia, eclampsia and severe eclampsia which are hypertensive disorders of pregnancy are shown in Table 3.

Maternal age may be a risk factor for developing preeclampsia. We found women with preeclampsia were in the age 29.2 ± 5.1 years. Tyas *et al* found that out of 148 participants, 43 women were above 35 years and 105 were in the age group of 20-35 years^[12]. Lamminpää, *et al* reported that preeclampsia occurred in 9.4% of women with advanced maternal age and in 6.4% were below 35 years^[13]. The finding of maternal age in pre-eclampsia in both these studies are similar to our study.

A meta-analysis by Chu *et al* has reported that there is increased risk of caesarean delivery in overweight and obese pregnant women as compared to pregnant women with normal weight^[14]. We found that 76 were overweight and 77 women were obese.

Serum magnesium levels were not statistically significant in women with and without preeclampsia in our study. Darkwa *et al* ^[15] and Roy *et al* ^[16] found no significant difference in serum magnesium levels in women with preeclampsia and normal pregnant women. However, Saputri, *et al*, Kharb *et al* and Sandip *et al* ^[17-19] reported low serum magnesium levels in severe preeclampsia as compared to normal pregnant women.

The current hypothesis which explains the cause of pre-eclampsia is impaired trophoblastic implantation and placental perfusion. There is secondary endothelial damage which may reduce organ perfusion as well. Age, parity and family history have been implicated as predisposing factors^[20].

Decreased magnesium levels increased production of

vasoactive agents and cytokines which stimulates contraction which in turn may trigger high blood pressure seen in preeclampsia^[16].

The therapeutic use of magnesium in eclampsia is well established which also emphasizes its importance.

The role of magnesium in preterm labour is explained by its inhibitory role on uterine myometrial contractions. Increased levels of extracellular magnesium inhibit entry of calcium into the myometrial cells. Thus, hypomagnesemia may induce hyperexcitability of uterine muscles and cervical dilatation and this in turn may lead to preterm labour^[21].

Antenatal women with decreased serum magnesium levels did not have preterm labour however, 35 women with normal magnesium levels did have this adverse outcome of preterm labour. This finding in our study is contrary to those of Malathi &Maddipatti, Meena & Maheshwari, Okunade *et al*, Ferdous *et al* ^[22,21,6 23] who found an association between hypomagnesemia and preterm labour.

The association of age, BMI and gestational age, and diastolic blood pressure suggest that these factors are predictors of adverse maternal outcomes. Serum magnesium levels may be an important risk factor as it was not estimated at again at the time of delivery and hence its association may not be significant.

Limitations of the Study: The study was carried out on a small cohort of antenatal women in an urban population. Serum magnesium levels were evaluated only once at 24-26 weeks of gestation. Estimation of serum magnesium in who developed pre-eclampsia and preterm labour was not done.

Conclusion

Magnesium deficiency was observed in antenatal women with and without pre-eclampsia. Antenatal women who developed preterm labour had normal serum magnesium levels. This emphasizes that serum magnesium should be evaluated in antenatal women and its deficiency may predict maternal outcomes.

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