Section: Obstetrics and Gynaecology

Original Research Article

# A COMPARATIVE STUDY OF SERUM MAGNESIUM LEVELS IN PRETERM LABOUR AND TERM LABOUR PATIENTS AND ITS PROGNOSTIC SIGNIFICANCE IN A TERTIARY CARE CENTRE

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## Abstract

**Background:** Preterm delivery (28-37 weeks) is a major cause of perinatal and neonatal mortality, accounting for 50% of the cases. Preterm labour is linked to changes in cellular biochemical functions, especially magnesium levels. This study aimed to measure and correlate serum magnesium levels in preterm and term labour mothers and to evaluate their role in preventing preterm labour. **Materials and Methods**: This prospective comparative study included 100 pregnant women where the case group included 50 preterm labour patients (28-36+6 weeks) and the control group included 50 term labour patients (≥ 37 weeks). The serum magnesium levels were assessed using the colorimetric endpoint method. Data collection included history, socioeconomic assessment, physical and gynaecological examinations, and laboratory tests. **Results**: Women with preterm labour had significantly reduced serum magnesium levels, with a mean serum magnesium level of 1.40±0.39, whereas patients with term labour had a mean serum magnesium level of 2.39±0.013. The difference in serum magnesium levels between the preterm and term populations was independent of maternal age, parity, gestational age, and socioeconomic factors. In the preterm group, natural labour was the most common (40%), followed by LSCS (8%), and breech delivery (2%), with no vacuum or forceps deliveries. In the term group, natural labour was the most frequent (31%), followed by LSCS (16%), vacuum delivery (2%), and outlet forceps delivery (1%), with no breech deliveries. **Conclusion**: Serum magnesium levels can predict preterm labour, and simple magnesium supplementation may help prevent preterm labour by offering a cost-effective solution to reduce preterm labour complications.

## INTRODUCTION

Preterm labour is defined as the onset of labour with periodic and frequent uterine contractions accompanied by progressive cervical changes before the completion of 37 weeks of gestation in a pregnancy that has completed 20 weeks of gestation.[1] According to the World Health Organization (WHO), preterm labour begins before the 37th week (< 259 days) of gestation, starting on the first day of the last menstrual period.[2] The most common causes of preterm labour are idiopathic and spontaneous, with premature rupture of membranes (PROM) being a significant risk factor. Other risk factors include multiple pregnancies, hypertensive disorders of pregnancy, infections, cervical incompetence, antepartum haemorrhage, foetal and uterine anomalies, anaemia, heavy work, and smoking. Socioeconomic status and geographic location also influence the occurrence of preterm labour, which affects the mother, child, family, and society.[3]

Preventing idiopathic and spontaneous preterm deliveries in viable foetuses requires appropriate antenatal care. One way to identify women at high risk for preterm labour is to test the predictors involved in the disease mechanism. However, the predictors and tests used to prevent and treat preterm deliveries are poorly understood.[4] Pathologically, preterm labour may be largely attributed to changes in basic biochemical functions at the cellular level, particularly in the availability of


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trace elements. Therefore, Mg is of great importance.[5]

Magnesium is the second most common intracellular cation and the fourth most abundant cation in the human body.[6] It is crucial in metabolising major nutrients such as carbohydrates and fats. Magnesium deficiency is associated with various complications during pregnancy, including hypertension, intrauterine growth retardation (IUGR), preeclampsia, low birth weight, leg cramps, and preterm labour. It is well known that serum magnesium levels decrease as pregnancy progresses. This decrease in magnesium levels is significant in the physiology of childbirth, as magnesium negatively affects myometrial contractions.[7]

Hypomagnesaemia is suggested to augment myometrial contractions, leading to uterine hyperactivity, contractions, and eventually labour. Decreased serum magnesium levels also affect cervical dilation.[8] Different studies have shown varying patterns of reduction in magnesium levels during pregnancy, with the prevalence of magnesium deficiency ranging from 4.6% to 48%.[9] Studies have shown that improving magnesium levels through supplementation can enhance both maternal and perinatal outcomes by reducing hypertension during pregnancy, premature termination of pregnancy, preterm labour, and intrauterine growth retardation. It also lowers the incidence of low-birth-weight babies and sudden infant death syndrome (SIDS) in neonates and reduces the risk of preeclampsia and eclampsia in hypertensive and normotensive antenatal mothers.[10]

Determining magnesium deficiency is challenging because < 1% of the total body magnesium circulates in plasma. In addition, assays for detecting ionised Mg levels are expensive. By measuring and comparing serum magnesium levels in preterm and term labour patients, this study sought to establish the significance of magnesium as a predictor and potential preventive measure for preterm labour. These findings could lead to better antenatal care practices and improved maternal and perinatal outcomes through magnesium supplementation.

**Aim**

This study aimed to measure the serum magnesium levels in preterm and term labour mothers and to correlate the serum magnesium levels in preterm and term labour patients.

## MATERIALS AND METHODS

This prospective comparative study was conducted with 100 pregnant women at the Department of Obstetrics and Gynaecology of the Mahatma Gandhi Memorial Government Hospital, Tiruchirappalli, from January to August 2022. This study was approved by the Institutional Ethics Committee before initiation, and informed consent was obtained from all patients.

**Inclusion Criteria**

Patients with singleton gestation, preterm onset of labour between 28 and 36 weeks+6 days of gestation, active labour, and intact amniotic membrane were included in the study.

**Exclusion Criteria**

Patients with a previous history of recurrent abortion and preterm delivery, recurrent urinary tract infection, pregnancy-related complications, including preeclampsia, polyhydramnios, antepartum haemorrhage, cervical incompetence, any uterine malformations, and systemic illnesses such as hyperbilirubinemia, haemolytic disorder, hyperlipidaemia, Waldenstrom macroglobulinaemia, and known diagnosis of foetal congenital malformations were excluded from the study.

**Methods**

The case group consisted of 50 patients with preterm onset of labour (gestational age between 28 weeks and 36+6 days) who had preterm deliveries. The control group consisted of 50 uncomplicated patients with the onset of term labour (gestational age ≥ 37 weeks). The serum magnesium levels of the patients were assessed. Two millilitres of venous blood were drawn from each participant upon admission to the labour ward. The samples were transported to the Central Laboratory of Mahatma Gandhi Memorial Government Hospital to estimate the serum magnesium levels using the colourimetric endpoint method. This method involves the formation of a purple complex with xylidyl blue in an alkaline solution, and the magnesium concentration is measured photometrically based on the decrease in the absorbance of xylidyl blue. Testing was conducted using the Roche/Hitachi COBAS C system.

Data collection included detailed and comprehensive history taking, assessment of socioeconomic status, physical examinations (general, local, systemic, and per abdominal), and meticulous per speculum and per vaginal examinations. Laboratory tests included complete blood count (CBC), RFT, LFT, and routine urine tests.

**Statistical Methods**

Data were entered into Microsoft Office Excel 2007 and analysed using SPSS version 23.0. The prevalence of outcomes and categorical determinant variables were presented as proportions, and statistical analysis was performed using the chi-square test for discrete variables. Quantitative variables are presented as mean and standard deviation and statistical analysis was conducted using the student's t-test for continuous variables. Statistical significance was set at $p < 0.05$.


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## RESULTS

The highest proportion of preterm (46%) and term (40%) mothers was in the 26-30 age group, indicating a similarity in age distribution. A higher percentage of term mothers were graduates (52%) than preterm mothers (36%), who had more participants with a middle-level education (30%). Socioeconomic status analysis revealed that both preterm (44%) and term (48%) mothers predominantly belonged to the middle class, with lower socioeconomic status being more prevalent among preterm mothers (8%) than among term mothers (2%). In the preterm delivery group, natural labour was the most common (40%), followed by LSCS (8%) and breech delivery (2%), with no vacuum or forceps deliveries. In the term group, natural labour was the most frequent (31%), followed by LSCS (16%), vacuum delivery (2%), and outlet forceps delivery (1%), with no breech deliveries. [Table 1]

The obstetric characteristics of preterm and term mothers showed that both groups had a similar distribution of gravidity, with the highest proportion being G1 (36% preterm, 34% term) and G2 (36% preterm, 38% term). Term mothers showed a higher proportion of multiparous women, with 58% having at least one previous child, compared to 48% of preterm mothers. In terms of live births, term mothers had a higher rate of giving birth to at least one live child (62%) than preterm mothers (46%). Abortion was more evenly distributed among groups. [Table 2]

The study observed significant differences in the distribution between preterm and term mothers. Preterm mothers predominantly delivered at earlier gestational ages, with the highest proportion (44%) delivering between 31-34 weeks and the lowest (22%) delivering between 28-30 weeks. Term mothers were mostly represented by deliveries occurring at full term, with the highest proportion (58%) delivering at 38 weeks and the lowest (14%) at 40 weeks. [Table 3]

Among term mothers, 76% had magnesium levels below 1.6 mg/dL, 16% had levels between 1.6-2 mg/dL, 6% had levels between 2.1-2.5 mg/dL, and 2% had levels above 2.5 mg/dL, with a mean magnesium level of 2.36±0.138 mg/dL. Among preterm mothers, 86% had magnesium levels between 2.1-2.5 mg/dL, and 14% had above 2.5 mg/dL, with no preterm mothers having below 1.6 mg/dL or between 1.6-2 mg/dL, and a mean magnesium level of 1.4±0.396 mg/dL and these differences were statistically significant ($p < 0.001$). [Table 4]

The correlation coefficient was high (0.937), implying an increased gestational age and serum magnesium levels. A significant positive correlation was observed between serum magnesium levels and gestational age (p=0.001). [Table 5 and Figure 1]

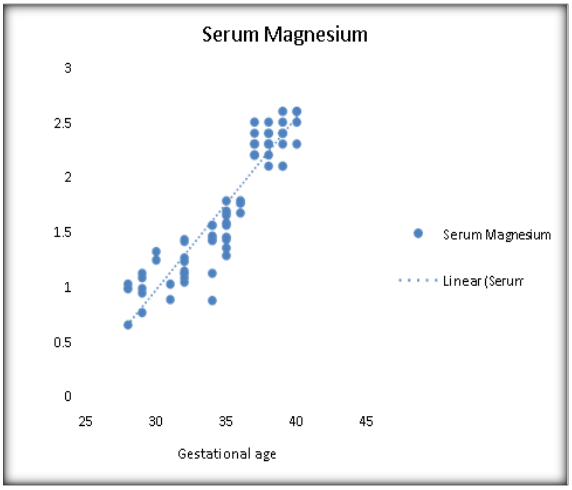


**Figure 1: Correlation of serum magnesium levels with Gestational age**

**Table 1: Demographic distribution among preterm and term mothers**

| | | Preterm | Term |
|---|---|---|---|
| **Age groups (years)** | **15-20** | **6 (6%)** | **10 (10%)** |
| | 21-25 | 34 (34%) | 36 (36%) |
| | 26-30 | 46 (46%) | 40 (40%) |
| | 31-35 | 7 (7%) | 14 (14%) |
| Distribution of education | Primary | 4 (4%) | 14 (14%) |
| | Middle | 30 (30%) | 24 (24%) |
| | High/Hr sec | 30 (30%) | 10 (10%) |
| | Graduates | 36 (36%) | 52 (52%) |
| Distribution of socioeconomic status lower | Lower | 8 (8%) | 2 (2%) |
| | Lower middle | 34 (34%) | 32 (32%) |
| | Middle | 44 (44%) | 48 (48%) |
| | Upper middle | 14 (14%) | 18 (18%) |
| Mode of delivery | Labour natural | 40 (40%) | 31 (31%) |
| | LSLS | 8 (8%) | 16 (16%) |
| | Breech | 2 (2%) | 0% |
| | Vacuum delivery | 0% | 2 (2%) |
| | Outlet forceps | 0% | 1 (1%) |

**Table 2: Obstetric characteristics among preterm and term mothers**

| Obstetrics code | | Preterm | Term |
|---|---|---|---|
| Gravida | 1 | 36 (36%) | 34 (34%) |


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| | | | |
|---|---|---|---|
| | 2 | 36 (36%) | 38 (38%) |
| | 3 | 20 (20%) | 24 (24%) |
| | 4 | 8 (8%) | 4 (4%) |
| Para | 0 | 46 (46%) | 58 (58%) |
| | 1 | 48 (48%) | 38 (38%) |
| | 2 | 6 (6%) | 4 (4%) |
| Livebirth | 0 | 48 (48%) | 62 (62%) |
| | 1 | 46 (46%) | 34 (34%) |
| | 2 | 6 (6%) | 4 (4%) |
| Abortion | 0 | 48 (48%) | 62 (62%) |
| | 1 | 46 (46%) | 34 (34%) |
| | 2 | 6 (6%) | 4 (4%) |

**Table 3: Distribution of gestational age among preterm and term mothers**

| | Gestational age | Frequency (%) |
|---|---|---|
| Preterm (weeks) | 28-30 | 22 (22%) |
| | 31-34 | 44 (44%) |
| | 35-37 | 34 (34%) |
| Term (weeks) | 38 | 58 (58%) |
| | 39 | 28 (28%) |
| | 40 | 14 (14%) |

**Table 4: Serum Magnesium Levels**

| Serum magnesium levels | Preterm | Term | P -value |
|---|---|---|---|
| < 1.6 | 38 (76%) | 0% | 0.001 |
| 1.6-2 | 8 (16%) | 0% | |
| 2.1-2.5 | 3 (6%) | 43 (86%) | |
| > 2.5 | 1 (2%) | 7 (14%) | |
| Mean ± SD | 1.4±0.396 | 2.36 ± 0.138 | |

**Table 5: Correlation of serum magnesium levels with Gestational age**

| | Gestational age | |
|---|---|---|
| Serum magnesium levels | r value | 0.937 |
| | p-value | 0.001 |

## DISCUSSION

In our study, 22% of preterm mothers were in the 28-30 weeks gestational age range, while 58% of term mothers were at 38 weeks of gestation. The mean gestational age was significantly lower in preterm mothers than in term mothers ($p < 0.05$). Malathi and Maddipatti reported no statistically significant differences, potentially because of the small sample size.[11] We also observed a significant positive correlation ($r = 0.937$) between gestational age and serum magnesium levels, which is consistent with the findings of Bartl et al., suggesting a relationship between these variables.[12] In contrast, Honest et al. and Okunade et al. found minimal to no correlation in term mothers but a positive correlation in preterm mothers, consistent with our results.[13,14] These findings highlight the intricate interplay between gestational age and serum magnesium levels, and their implications in preterm labour.

In our study, we found that the mean serum magnesium level in preterm mothers was 1.4±0.39 and in term mothers was 2.36±0.13. The preterm group had a higher proportion of patients with low serum Mg levels. The serum magnesium level was < 1.6 in 76% of the preterm mothers, whereas in term mothers, there were no patients with serum magnesium levels < 1.6, and there was a significant difference in serum magnesium levels among preterm labour and term labour patients ($p < 0.001$). This indicates that serum magnesium levels play a significant role in the detection of preterm labour. It was also found that most term mothers had magnesium levels of > 2 mg/dl.

This is like a study conducted by Malathi and Maddipatti also found that the mean magnesium was 1.59±0.83 mg/dl for the patients with preterm labour and 2.55±0.40 mg/dl for those with term labour. The mean difference was statistically significant ($p < 0.001$), and it was concluded that the serum magnesium concentration decreased during preterm labour, like our study's results.[11] A survey conducted by Shahid et al. also stated that the mean magnesium level was 1.87±0.34 mg/dl for patients with preterm labour and 2.10±0.40 mg/dl for those with term labour, and there was statistical significance ($p < 0.05$), which is also comparable to our study report.[15] Another study by Begum et al. also found that serum magnesium levels were significantly decreased in preterm mothers with a mean value of 1.77±0.36 which is like our study report.[16] A study carried out by Puspo and Jagdish also found that serum magnesium level in preterm labour was found to be 1.67 ± 0.23 mg/dl which is consistent with our study report.[17]

A study conducted by Kurzel et al. also stated that the mean magnesium level was 1.60±0.46 mg/dl for patients with preterm labour and 2.30±0.40 mg/dl for those with term labour, and there was a


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statistically significant p-value < 0.05 which is also comparable to our study.[18] A study conducted by Smolarczyk et al. also stated that the mean magnesium was 1.64±0.04 mg/dl for the patients with preterm labour and 2.0±0.20 mg/dl for those with term labour and it is statistically significant with p < 0.05 which is also like our study report.[19]

A study conducted by Wójcicka et al. also stated that the mean magnesium was 1.63±0.05 mg/dl for the patients with preterm labour and there is the statistical significance with a p-value < 0.05 which is also comparable to our study report. Serum magnesium levels decrease during pregnancy with gestational age. This decrease in serum magnesium levels plays an important role in the physiology of parturition and preterm labour.[20] A study conducted by Ferdousdrd et al. found that the mean serum magnesium was found 1.64±0.13 mg/dl varied from 1.5-2.0 mg/dl in preterm mothers and 2.05±0.11 mg/dl varied from1.8-2.2 mg/dl in term mothers and the mean serum magnesium level was significantly (p < 0.05) decreased in preterm mothers which is inconsistent with our study report.[21]

The findings of the present study showed a close resemblance with those of Okunade et al., who found that 47.0% of preterm patients had serum magnesium levels of 1.6 mg/dL whereas only 25.0% of term patients had low serum magnesium levels, and the difference was statistically significant.[14] In our study, hypomagnesaemia was shown to be a significant risk factor for preterm labour, and serum magnesium levels should be measured in all cases of pregnancy to predict and prevent preterm birth.

## CONCLUSION

Preterm infants born prematurely are more likely to experience both immediate and long-term difficulties such as growth and developmental disabilities. Low maternal serum magnesium levels are associated with adverse pregnancy outcomes, including preterm labour and low birth weight.

Our study showed that low serum magnesium levels were significantly associated with preterm labour. Hence, serum magnesium levels can be used as a predictive tool for preterm labour, and serum magnesium levels must be estimated in pregnant women to prevent preterm labour. Magnesium supplementation may be considered in patients with decreased serum magnesium levels to prevent preterm labour.

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