Original Article

Hypomagnesemia During Pregnancy in Young Women Associated with Adverse Fetal Outcomes

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Abstract

Objective: To determine the frequency of hypomagnesemia in primigravida women and effects / association of fetal health outcomes in primigravida with hypomagnesemia

Methodology: This descriptive cross-Sectional study was conducted at PMC hospital Nawabshah from January to June 2023. Primigravida women age ranging from 18 to 26 years admitting for delivery and were willing to participate in study were included. Blood samples were collected and sent to diagnostic laboratory for serum magnesium level. Examination of newborn was done for any abnormality and condition of mother and newborn was assessed and confirmed by duty doctor. All the information was gathered on the pre-designed questionnaire.

Results: The frequency of magnesium deficiency was 59 (30.89%) out of 191 participants. Hypomagnesemia was significantly correlated with the preterm deliveries 46 (77.96%) out of 59 low serum magnesium women with ($p < 0.001$). There was also significant association between hypomagnesemia and low birth weight baby outcome and from our study data 39 (66.1%) out of 59 hypomagnesemia mothers had low birth weight babies with ($p < 0.014$) and there was significant association between hypomagnesemia and poor health outcome of the babies. Out of these 59 newborn babies 18 (30.5%) had poor health outcome ($p < 0.000$) and were referred to NICU for admission and further management and 7 (11.8%) died soon after delivery.

Conclusion: A magnesium deficit during pregnancy can have long-lasting effects on the mother, fetus, newborn, and children and serum magnesium level can be used as a predicting tool for idiopathic preterm labour.

Keywords**:** Hypomagnesemia, Primigravida, Preterm babies.

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Introduction

Pregnant women especially young and primigravida frequently experience hypomagnesaemia, especially in developing nations and low-income areas. It is yet unknown if hypomagnesaemia is linked to problems in human pregnancies, even given the widespread therapeutic use of magnesium during pregnancy and the data from animal studies that links hypomagnesaemia to unfavorable pregnancy outcomes.[1] Women are more likely than men to be magnesium deficient; this may be partly due to the fact that estrogen accelerates the body's use of magnesium, and as a result, women's hormonal cycles may impact and modify magnesium status.[2] Recent research indicates that low magnesium during pregnancy may be linked to unfavorable outcomes for both mother and fetus, such as preeclampsia and fetal growth retardation.[3] Pregnant women take iron, calcium, vitamin, and mineral supplements in addition to a higher-calorie diet to meet these needs. Among these, magnesium (Mg^{++}) is a vital mineral that is needed for a developing fetus's cell division and is a vital component of life chemistry for

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maintaining a healthy neuromuscular system. A magnesium deficit during pregnancy can result in low-birth-weight babies, premature labor, leg cramps, hypertension, and IUGR. Maternal Mg^{++} insufficiency during pregnancy affects fetal growth and placental development, which could have long-term health effects on the offspring.[5]

Serum magnesium readings have been used consistently in clinical practice to determine body magnesium status, despite the fact that the total serum magnesium content does not reflect more than 1% of the total body magnesium. As a result, the range of serum magnesium concentrations is 1.8–2.2 mg/dl−1 (0.75–0.95 mmol/l − 1 or 1.5–1.9 mEq/l − 1). Thus, hypomagnesemia is diagnosed in a patient whose serum magnesium levels are below the range that is regarded as normal.[6] Compared to women who delivered at term, several studies have shown that women who experienced either preterm labor or preterm delivery (<37 week) had considerably lower serum magnesium levels.[7] The primary cause of perinatal mortality and morbidity is preterm birth, and its prevalence is rising in certain developed nations. Through calcium antagonistic effects, magnesium may prevent premature uterine contractions; magnesium sulfate has been used as a tocolytic drug. However, taking a magnesium supplement throughout pregnancy is a straight forward, safe preventative step that may lower the chance of an early labor or birth.[8] Since blood serum concentration is the most common method used to measure magnesium levels, magnesium shortage may go unnoticed and its incidence may be overestimated in cases when serum levels appear normal.[9]

Prematurity is a serious obstetric problem that has increased in frequency recently. The incidence of preterm delivery has risen by almost 30% over the past few decades. These days, one in every eight babies is born prematurely, while the incidence varies greatly depending on the community under study and most preterm births are preceded by spontaneous labor. Preterm labor may result from low magnesium concentrations in pregnant women's myometrium, which are caused by hypomagnesaemia during pregnancy, which lowers the magnesium level in the myometrium. The uterine smooth muscle is relaxed by elevated serum magnesium levels, which is why magnesium sulfate was once used as a tocolytic drug during pregnancy.[10]

According to the World Health Organization; both industrialized and developing nations have subclinical magnesium deficits. There are few and inconsistent studies on the prevalence of hypomagnesemia in the general population. The frequency of magnesium shortage may have been underestimated by these investigations, which evaluated serum magnesium levels, despite reports of a range between 2.5% and 15% in otherwise healthy individuals. As most magnesium is found intracellularly, serum magnesium levels are only 0.3% and the circulation contains 1% or less of the mineral. This makes blood magnesium levels as a measure of insufficiency inaccurate.[11] Taking above controversial data and lack of national comprehensive evidence, this study has been done to evaluate the frequency of hypomagnesemia in primigravida women and effects / association of fetal health outcomes in primigravida with hypomagnesemia.

Methodology

A descriptive cross-sectional study was carried out at Gynecology and Obstetrics department of PMC Hospital Nawabshah from January 2023 to June 2023. The sample size of one hundred ninety-one participants was recruited using the non-probability convenience sampling. Primigravida women age ranging from 18 to 26 years admitting for delivery and were willing to participate in study were included. Multigravida women, age above 26 years or less than 18 years, having any comorbidity and not willing to participate. Blood samples were collected and sent to diagnostic laboratory for serum magnesium level and reports were collected on due time. Examination of newborn was done for any abnormality and condition of mother and newborn was assessed and confirmed by duty doctor. Anthropometric measures for newborn were done soon after birth. All the sociodemographic information including study outcomes as per objective were gathered on the pre-designed questionnaire.

Information was summarized and data was analyzed by using hand sort techniques, MS office and Statistical Package for Social Sciences (SPSS version 26.0). For categorical variables, frequency, percentage and p value were calculated by using cross tabulation. The data was formulated through Graphs and Charts.

Results

Most of the participants (46.07%) were found with age range of 24 to 26 years, followed by 21 to 23 years (36.65%), and 18 to 20 years (24.08%) with an overall

average of 22.81 ± 2.49 years. A slight majority of participants reside in rural areas (52.9%) compared to urban areas (47.1%). According to the educational status most participants had secondary education (61.8%), while 28.8% had primary level education, and 9.4% were graduates. Majority of the women were housewives (82.2%), while smaller proportion being employed (14.7%) and skilled persons (3.1%). Out of all, 57.6% of participants belonged to the upper middle class, while 42.4% had lower middle class. Most of the patients underwent vaginal delivery (NVD) 69.64% compared to lower segment cesarean section (LSCS) (30.36%). Out of all, 56.0% of participants reached full term, 30.9% had preterm deliveries, and 13.1% had post-term pregnancies.(**Table I**)

Table I: Patient's demographic characteristics. (n=191)

Characteristics	Categories	Frequency	(%)
Age of the Participants	18 to 20 years	46	24.08%
	21 to 23 years	59	36.65%
	24 to 26 years	88	46.07%
Residence of Participants	Urban	90	47.1%
	Rural	101	52.9%
Educational status	Primary	55	28.8%
	Secondary	118	61.8%
	Graduate	18	9.4%
Occupation of the Participants	Employed	28	14.7%
	Skilled Person	6	3.1%
	House Wife	157	82.2%
Socioeconomic Status of Participants	Lower Middle Class	81	42.4%
	Upper Middle Class	110	57.6%
Mode of Delivery	NVD	133	69.6%
	LSCS	58	30.4%
Term of Pregnancy	Preterm (<37week)	59	30.9%
	Full Term (37week)	107	56.0%

Table II: Mean and Standard deviation of Age of the participants and Serum Magnesium level. (n=191)

	Mean Std. Deviation	Min	Max
Age of the Participants (Years)	22.81 ± 2.49	18	26
Birth weight (Kg)	2.513 ± 0.37	1.4	3.5
Serum Magnesium (mg/dl)	2.042 ± 0.39	1.1	3.0

Overall average age of the patients was of the participants was 22.81 ± 2.49 years, Weight of the baby at the time of birth (2.513 ± 0.37 Kg) and Serum Magnesium level (2.042 ± 0.39 mg/dl) of the participants at the time of delivery. Table II

The frequency of hypomagnesemia in primigravida women at the time of delivery was 59 (30.89%) according to present study data. Figure 1

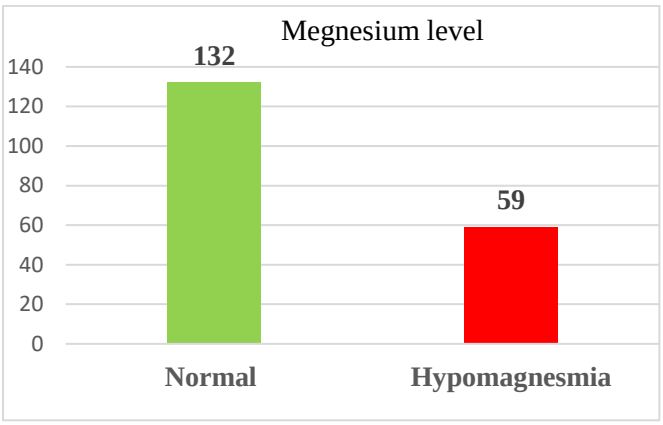

Figure. 01: Frequency of Hypocalcemia in Primigravida women at the time of delivery (n=191)

The association between hypomagnesemia during pregnancy showed a significant impact on the term of pregnancy, with 46 out of 59 participants with hypomagnesemia (77.96%) experiencing preterm deliveries (p-value = 0.001). Additionally, there was a significant association between hypomagnesemia and low birth weight, as 39 out of 59 participants with hypomagnesemia (66.1%) had low birth weight babies (p-value = 0.014). **Table III**

Table IV: Association between maternal Serum Magnesium level newborn outcomes at the time of birth (n=191)

Status of Magnesium	Fetal outcomes			Total	p-value
	Healthy Recovery	Ill health / Need care	Death		
Normal	108	22	2	132	0.001
Hypomagnesemia	34	18	7	59	
Total	142	40	9	191	

The above table shows the association between hypomagnesemia during pregnancy and its effect on health outcome of babies at the time of delivery. There was significant association between hypomagnesemia and poor health outcome of the babies. Out of 191 participants 108 participants had normal magnesium level and 59 had hypomagnesemia. Out of these 59

Table III: Association of Serum Magnesium level with birth weight and preterm birth (n=191)

Status of Magnesium	Term of Pregnancy			p-value	Status of baby weight (Kg)		p-value
	Preterm	Full term	Post term		Normal	Low Birth weight	
Normal	13	96	23	0.001	101	31	0.014
Hypomagnesemia	46	11	2		20	39	
Total	59	107	25		121	70	

deliveries 34 (57.6% had healthy recovery, 18 (30.5%) had poor health outcome and were referred to NICU for admission and further management and 7 (11.8%) died soon after delivery. Statistically Significant Value was 0.001.(Table IV)

Discussion

Magnesium is a vital trace metal that is required for many human metabolic processes. It is essential to about 600 enzymatic activities in biology that are connected to the competence of the immune system, bone formation, neuromuscular functioning, protein synthesis, and mitochondrial functions. The magnesium level influences both fetal development during pregnancy and infant growth throughout the perinatal period. A lower risk of certain health complications for mother and child during pregnancy, such as reduced fetal growth, intrauterine growth restriction, gestational diabetes, premature labor, and pre-eclampsia, is linked to magnesium shortage.[12] For the regulation of blood pressure, magnesium is necessary. High in potassium and magnesium, fruits and vegetables are associated with lowered blood pressure during pregnancy. Thirty-three percent of patients with low magnesium levels will develop preeclampsia because magnesium is essential to the development of preeclampsia during pregnancy. Preeclampsia and hypertension during pregnancy are associated with magnesium deficiency.[13]

Frequency of hypocalcemia was measured in our study participants who were primigravida and were admitted for delivery or LSCS and it was noted that 59 (30.89%) participants had low serum magnesium level. Enaruna NO, et al conducted a pilot study to find the mean serum magnesium level for the female patient population at the University of Benin Teaching Hospital. According to the study's findings, the prevalence of magnesium shortage during pregnancy has been estimated to range from 4.6% to 48%. A magnesium deficit during pregnancy can have long-lasting effects on the mother, fetus, newborn, and children. There were no maternal mortality were present. This is also in accordance with our study as well.[14]

Women in preterm labour (>37 weeks of gestation) had significantly reduced serum magnesium level (with mean 2.042 ± 0.39) compared to those delivered at term (37 weeks of gestation). In our study 46 (77.97%) out of 59 hypomagnesemia mothers had preterm delivery (p-value 0.014). Perterm deliveries always have poor neonatal outcome and remain one of the leading causes of mortality and morbidity in neonates. Mortality was also high in these neonates; this may be because of preterm and prematurity and other causes. This is in accordance with a study conducted by Mahmoud SA, eta al who also concluded that serum magnesium levels can serve as a predictive tool for idiopathic preterm labor. The number of preterm labor patients with hypomagnesemia was significantly higher than those who delivered at term.[15]

Hypomagnesemia is linked with poor baby outcome and prolonged hospital stay. Babies delivered to mothers with low serum magnesium have low birth weight babies, preterm babies and majority of the babies need special care and admission to NICU after birth for further management. In a study conducted by Atiba AS, et al[16] revealed that it seems that hypomagnesaemia is a side effect of pre-eclampsia. Magnesium serum levels were normal prior to the onset of the illness. This biomarker's serum level has a major impact on the outcome for the mother and fetus. Their study's conclusions demonstrated a statistically significant link between low birth weight, preterm delivery, and the necessity for a baby of moms with low serum magnesium levels to be admitted to a special care baby unit. This is in accordance with our study as well. Our findings were supported by studies like Ferdous D et al[17] observed that the preterm labor was substantially associated with a lower serum magnesium concentration and in a meta-analysis by Zhang Y et al[18] indicated that the interventional and observational studies revealed that the sufficient magnesium intake during pregnancy could potentially decrease the prevalence of preterm birth.18 In aligns to this series Astha et al[19] concluded that the reduced levels of serum magnesium are linked to preterm labor, and assessing serum magnesium during pregnancy could serve as a valuable indicator for predicting preterm labor. However, inconsistently, Shepherd E et al.[20] reported that their findings do not support clear associations between antenatal magnesium sulfate used for beneficial indications and adverse neonatal outcomes. Magnesium is a vital trace element crucial for numerous biochemical processes in humans. It plays a key role in over 600 enzymatic reactions involved in protein synthesis, mitochondrial functions, neuromuscular activities, bone development, and immune system efficiency.[20] Adequate magnesium levels are important for fetal development during pregnancy and for growth in newborns during the perinatal period. Additionally, magnesium can affect fetal programming and the manifestation of diseases in both childhood and adulthood.[17] However, the maternal magnesium level should be routinely screened during

antenatal visits, just like other essential investigations. Monitoring and maintaining adequate magnesium levels can help prevent preterm births and adverse fetal outcomes. Integrating magnesium screening into prenatal care can provide early intervention opportunities, promoting optimal fetal development and reducing the risk of complications associated with magnesium deficiency.

Conclusion

Study identified that the hypomagnesemia among women during pregnancy linked to preterm labor and low birth weight. It should be routinely screened out during antenatal visits. As per findings it can be utilized as a predictive marker for preterm labor and low birth weight risks. Nevertheless, the findings cannot be considered definitively conclusive due to several significant study limitations, such as the limited sample size of the study. Hence, comprehensive and longitudinal studies are recommended to validate these findings thoroughly.

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