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To find association of socio-demographic factors of pregnant women with hypomagnesaemia

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Abstract

Magnesium is the second most common intracellular cation which is essential in metabolic processes, protein synthesis, membrane integrity, nervous tissue conduction, neuromuscular excitability, muscle contraction. In obstetrics magnesium has an important role in maternal and foetal wellbeing. Limited data is available in our state to find hypomagnesaemia during pregnancy and its association with socio-demographic profile of the women so the present study was done to find association of socio-demographic factors of the pregnant women with hypomagnesaemia.

Methods: This was a hospital based cross-sectional study. 100 women in their third trimester of pregnancy and were included in the study after obtaining written informed consent. After detail history and examination, serum magnesium was measured. And data were analyzed.

Results: Risk of hypomagnesaemia was 1.3 times in women who are ≥ 25 years, 1.5 times in urban women,3 times in obese women and 3 to 4 times in pre-eclamptic women. No significant association between hypomagnesaemia and gravid and parity. Women with gestational age <34 weeks are 2.7 times at risk of hypomagnesaemia. There was a weak positive correlation between gestational age and serum magnesium and a weak negative correlation between maternal serum magnesium and maternal age, systolic blood pressure and diastolic blood pressure.

Conclusion: Magnesium should be measured in every pregnant women so that magnesium deficiency can be identified early and adequate measures and magnesium supplementation can be given to prevent untoward complications.

Keywords: Hypomagnesaemia; Pregnancy; Socio-demographic factors; Pre-eclampsia

1. Introduction

Pregnancy is a state of increased demand for nutrients like iron, calcium, zinc, copper, magnesium and other micronutrients. These nutrients are required for the normal growth and development of the foetus. Deficiency of any of these could affect pregnancy, delivery and outcome of pregnancy[1].Magnesium is the second most common intracellular cation, doing an essential role in many physiologic functions. It is important in energy requiring metabolic processes, protein synthesis, membrane integrity, nervous tissue conduction, neuromuscular excitability, muscle contraction, hormone secretion and intermediate metabolism[2]. Magnesium helps keep blood pressure normal, bones strong, and the heart rhythm steady. It contributes to bone matrix development and is required for the synthesis of bio-macromolecules including DNA, RNA, and protein[3].

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Approximately 1% of total body magnesium is in serum and interstitial body fluid, with the remainder in bone, muscle, and soft tissue[3]. The normal plasma magnesium concentration is 1.7-2.2 mg/dl (1.2-1.9 meq/l; 0.85-1.10 m mol/l) with some variation between clinical laboratories[3]. Magnesium homeostasis is largely controlled by the kidney, with reabsorption occurring predominantly in the thick ascending limb of the loop of Henle (70–80%) and, to a lesser extent (10–15%), in the distal convoluted tubule[4]. It is regulated by many hormonal and nonhormonal factors, and reabsorption is closely linked to that of calcium[4].

Spices, nuts, cereals, cocoa, and vegetables are rich source of Magnesium. A daily intake (DI) of 300 mg for men and 270 mg for women, is necessary to maintain Magnesium balance under typical physiological conditions[3].

Low Mg levels have been found to have a direct relationship with the risk of (T2DM), poor glycemic control, and IR[5,6]. Low Mg levels also promote inflammation, leading to an increased level of systemic inflammatory markers, and predisposing to atherosclerosis and hypertension[7,8]. In obstetrics magnesium has an important role in maternal and foetal wellbeing. It is required for cell multiplication in a growing foetus and is an essential element of life chemistry, keeping a balanced neuromuscular system[3].

Pregnant women tend to have low magnesium level than non-pregnant because of increased demand of mother and growing fetus and increased renal excretion of magnesium i.e. 25% more than non-pregnant women due to increase GFR (glomerular filtration rate) in the second and third trimester[9]. Various reasons for the low levels of Magnesium in pregnancy are inadequate intake, increased metabolic demand of pregnancy, especially as gestation advances, physiological haemodilution in pregnancy, and increasing parity[10,11]. Magnesium supplementation during pregnancy was associated with significantly fewer maternal hospitalizations, a reduction in preterm delivery, and less frequent referral of the newborn to the neonatal intensive care unit[3,12].

Limited data is available in our state to find hypomagnesaemia during pregnancy and its association with socio-demographic profile of the women so the present study was done to find association of socio-demographic factors of the pregnant women with hypomagnesaemia.

2. Material and methods

This was a hospital based cross-sectional study conducted in the Department of Obstetrics and Gynaecology, S.M.S. Medical College, Jaipur. 100 women in their third trimester of pregnancy and who were willing to participate in the study were included in the study after obtaining written informed consent. Women with chronic medical disorders, Intra-uterine foetal death and twin pregnancy were excluded from the study. After detail history and examination, 5 ml venous blood is collected to measure serum magnesium. Serum magnesium less than 1.7 mg% was considered as low. Data were entered in to MS Excel sheet and statistically analysed. A p value <0.05 was taken as significant.

3. Results

In present study out of 100 women, 22 women (22%) had low serum magnesium levels.

Table 1 shows association between hypomagnesaemia and maternal variables. Women who were 25 years or older were at 1.3 times more risk of having hypomagnesaemia though it was statistically not significant (p=0.5). Women from urban dwellings were one and half times more at risk of hypomagnesaemia. Overweight and obese women were approximately 3 times more at risk of hypomagnesaemia. There was no significant difference in age (p=0.5), residence (p=0.4), religion (p=0.7), literacy status (p=0.1), socio-economic status (0.2, 0.8) and BMI (0.05). Out of 22 women with hypomagnesaemia, 7 women (31.8%) had systolic BP <140 mm of Hg and 15 women (68.2%) had systolic BP ≥140 mm of Hg. Women with systolic BP ≥140 mm of Hg had significantly high risk of having hypomagnesaemia [4.6 (1.5531-13.8403; p=0.006)]. Out of 22 women with hypomagnesaemia, 6 women (27.3%) had diastolic BP <90 mm of Hg and 16 women (72.7%) had diastolic BP ≥90 mm of Hg. Women with diastolic BP ≥90 mm of Hg had significantly high risk of having hypomagnesaemia [3.4 (1.2203-9.7592; p=0.01)].

Table 1 Determination of the association between hypomagnesaemia and maternal variables

Maternal Variables	Hypomagnesaemia		Inferential Statistics	
	Yes (n=22) No (%)	No (n = 78) No (%)	OR [95% CI]	P – value
Age				
<25	6 (27.3)	26 (33.3)	1.3 [0.4667 – 3.8093]	0.5
≥25	16 (72.7)	52 (66.7)		
Residence				
Urban	15 (68.2)	46 (58.9)	1.5 [0.5461 -4.0693]	0.4
Rural	7 (31.8)	32 (41.1)		
Religion				
Hindu	15 (68.2)	56 (71.8)	0.8 [0.3024 – 2.3434]	0.7
Muslim	7 (31.8)	22 (28.2)		
Literacy Status				
Illiterate	8 (36.4)	41 (52.6)	0.5 [0.1944 – 1.3682]	0.1
Literate	14 (63.6)	37 (47.4)		
S E Status				
Lower	9 (40.9)	39 (50.0)	0.3 [0.0502 – 2.3859]	0.2
Middle	11 (50.0)	36 (46.2)	0.4 [0.0677 – 3.1026]	0.8
Upper	2 (9.1)	3 (3.8)	1	
BMI (kg/m²)				
<25	6 (27.3)	38 (48.7)	2.8 [0.9941 – 7.9260]	0.05
≥25	16 (72.7)	40 (51.3)		
SBP				
<140 mm of Hg	7 (31.8)	45 (57.7)	4.6 [1.5531-13.8403]	0.006
≥140 mm of Hg	15 (68.2)	33 (42.3)		
DBP				
<90 mm of Hg	6 (27.3)	44 (56.4)	3.4 [1.2203-9.7592]	0.01
≥90 mm of Hg	16 (72.7)	34 (43.6)		

Table 2 shows association between hypomagnesaemia and maternal obstetrical variables. No significant association was found between gravidity and hypocalcaemia (p=0.3). Risk of having hypomagnesaemia was 1.6 times more in multigravida women [1.6 (95% CI 0.6026 – 4.1116)]. No significant association was found between parity and hypomagnesaemia (p=0.1, 0.5). Women with past history of preterm birth had 3.1 times more risk of having hypomagnesaemia [3.1; 95% CI (1.0395 – 9.6874); p=0.04]. Women with past history of abortion had 3.2 times risk of having hypomagnesaemia [3.2; 95% CI (0.7902 – 13.3205); p=0.1]. Women with gestational age below 34 weeks had 2.7 times risk of having hypomagnesaemia [2.7(95% CI (1.0313 – 7.4819); p=0.04)].

Table 2 Determination of the association between hypomagnesaemia and maternal Obstetrical Variables

Maternal Obstetrical Variables	Hypomagnesaemia		Inferential Statistics	
	Yes (n = 22) No (%)	No (n = 78) No (%)	OR [95% CI]	P – value
Gravida				
Gravida 1	10 (45.5)	27 (34.6)	1.6 [0.6026 – 4.1116]	0.3
Gravida ≥2	12 (54.5)	51 (65.4)		
Parity				
Para 0	13 (59.1)	33 (42.3)	1	
Para 1	4 (18.2)	27 (34.6)	0.4 [0.1098 – 1.2875]	0.1
Para ≥2	5 (22.7)	18 (23.1)	0.7 [0.2166 – 2.2960]	0.5
Past preterm birth				
Yes	7 (31.8)	10 (12.8)	3.1 [1.0395 – 9.6874]	0.04
No	15 (68.2)	68 (87.2)		
Past abortion				
Yes	4 (18.2)	5 (6.4)	3.2 [0.7902 – 13.3205]	0.1
No	18 (81.8)	73 (93.6)		
Gestational Age				
<34	12 (54.5)	18 (23.1)	2.7 [1.0313 – 7.4819]	0.04
≥34	10 (45.5)	60 (76.9)		

There was a weak negative correlation between maternal serum magnesium and maternal age and the correlation was not significant (R = -0.0067; p = 0.9) (Table 3 and Figure 1)

Table 3 Pearson Correlation between S. Magnesium and age of the women

N = 100	Mean ± SD	R	R Square	Equation	P value
Age (years)	25.87±3.74	-0.0067	0.0000	Y= -0.0008373*X+2.030	0.9
S. Magnesium	2.01±0.46				

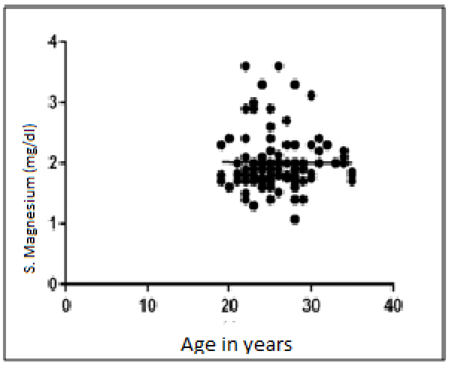

Figure 1 Correlation between age of the women and S. magnesium levels

There was a weak positive correlation between gestational age and serum magnesium levels and the correlation was statistically not significant (R =0.1301; p=0.1) (Table 4 and Figure 2)

Table 4 Pearson Correlation between S. Magnesium and gestational age

N = 100	Mean ± SD	R	R Square	Equation	P value
Gestational Age (Weeks)	34.16±2.69	0.1301	0.01693	Y = 0.002246*X + 1.241	0.1
S. Magnesium	2.01±0.46				

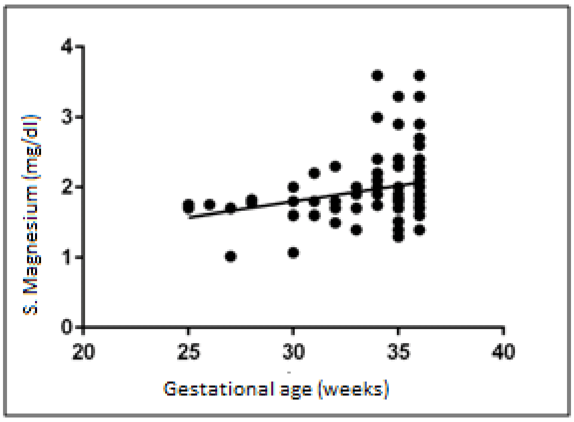

Figure 2 Correlation between gestational age and serum magnesium

Serum magnesium had a weak negative correlation with SBP but it was not significant (R = -0.0224; p= 0.8). Similarly S. Mg had a weak negative correlation with DBP but it was not significant (R = -0.01; p = 0.9). (Table 5 and Graph 3 & 4)

Table 5 Pearson Correlation between S. Magnesium and Blood Pressure

N = 100	Mean ± SD	R	R Square	Equation	P value
SBP	134.0±23.87	-0.0224	0.0005	Y= -0.0004*X+2.043	0.8
S. Magnesium	2.01±0.46				
DBP	86.1±14.9	-0.01	0.0001	Y= -0.0003*X+2.017	0.9
S. Magnesium	2.01±0.46				

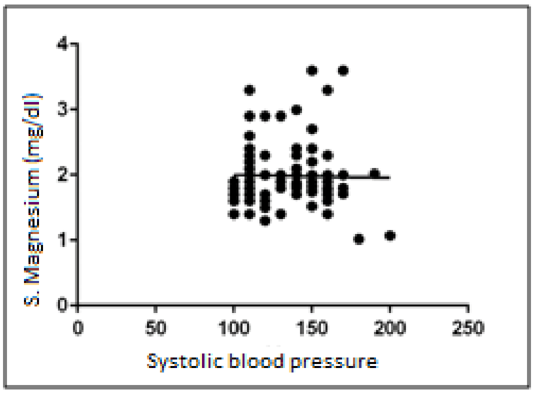

Figure 3 Correlation between systolic blood pressure and serum magnesium

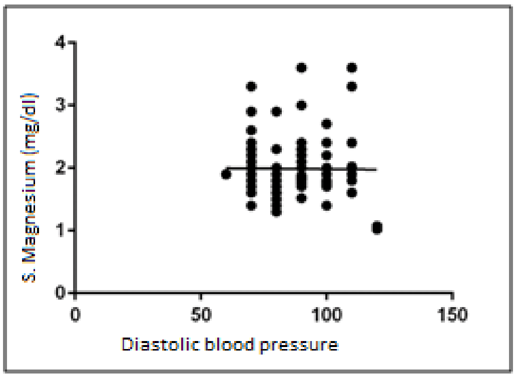

Figure 4 Correlation between diastolic blood pressure and serum magnesium

4. Discussion

In present study 22% women had hypomagnesaemia. Prevalence of hypomagnesaemia was much lower than that observed by Pathak P et al[10] (44%), Chandrika et al[13] (57%) and S Mangalesh et al[14] (40%) and higher than that observed by Enaruna et al[15] (16.5%). One of the main reasons for decreased magnesium levels in pregnancy may be reduced intake of magnesium rich diet. Studies done on dietary intake during pregnancy has demonstrated that most of the women in low income group has decreased intake of magnesium in their antenatal period[16].

In present studies 72.7% women with hypomagnesaemia were above 25 years with an odd ratio of 1.3 [0.4667 – 3.8093]. Our results were in line with that of Anand S et al[17]. They observed that with increasing age there is significant decrease in serum magnesium levels (p=0.002). They believed that this is likely a result of higher demands of pregnancy at an age characteristic of poor nutrition. However, in a study by Begum and Das, serum magnesium level was independent of maternal age[18]. This variation in result may be due to less number of patients taken in their study groups. S Mangalesh et al found no significant correlation between maternal Mg levels and maternal age[14].

Risk of hypomagnesaemia was 1.5 times more in women residing in urban area as compared to women residing in rural areas [1.5 (0.5461 -4.0693; p-0.4)] in present study. Anand S et al in their study observed that serum magnesium was less in urban and rural women but it was significantly less in women of rural areas[17]. However, Kumar et al, in their study reported that serum magnesium levels showed slight decrease in both rural and urban pregnant women cases compared to controls but the difference was statistically not significant[19]. The increased prevalence of hypomagnesaemia in urban setting is perhaps attributable to a reduced intake of Mg-rich food groups -vegetables, nuts, fruits, and oilseeds-primarily due to lifestyle choices. As processed foods continue to dominate the Indian market, micronutrient deficiencies will tend to ensue[14].

Present study shows that 50% women belonging to middle socio-economic group had hypomagnesaemia followed by lower socio-economic group (46.2%) and upper socio-economic group (3.8) which is in contrast with observation of Begum and Das where mean serum magnesium level was higher in middle-income group of women compared to low income group[18].

In present study hypomagnesaemia was more common in women with BMI ≥25 kg/m^2 (72.7%) than in women with BMI <25 kg/m^2. The risk of hypomagnesaemia was 2.8 times in women with BMI ≥25 kg/m^2. This was consistent with results that of Anand S et al[17] and Begum and Das[18], who found that mean serum magnesium level was higher in women with BMI >25kg/m2 compared to BMI ≤25kg/m^2.

Out of 22 women with hypomagnesaemia, 68.2% had systolic Blood pressure ≥140 mm of Hg and 72.7% women had diastolic pressure ≥90 mm of Hg. The risk of hypomagnesaemia was 4.6 times more in pre-eclampsia in terms of systolic blood pressure [4.6(1.5531-13.8403;p=0.006)] and risk of hypomagnesaemia was 3.4 times more in terms of diastolic blood pressure [3.4 (1.2203-9.7592;0.01)]. Our results were consistent with that of Chatchai Kreepala et al. they observed that pregnant women with low ionized magnesium fraction had increased risk of preeclampsia by 4.41 times when compared to the normal ionized magnesium fraction group (unadjusted OR = 4.41, 95% CI: 1.46–13.40;p=0.006)[20].

It was observed that with increase in gravidity risk of hypomagnesaemia is 1.6 times increased though it was not significant [1.6(0.6026 – 4.1116;p =0.3)]. Our results were consistent with results of Anand S et al where there was significant decrease in serum magnesium levels in gravida 2 and 3 as compared to gravid one[17]. Kumar correlated serum magnesium levels among pregnant women with increasing parity and found that pregnant women with parity 2 and more had lower serum magnesium level when compared to primigravida. He found that in primiparous pregnant women, mean serum magnesium value was 1.77±0.34mg/dL. Serum magnesium level in pregnant women with 2nd and 3rd parity was 1.58±0.19 and 1.52±0.26mg/dL respectively[19]. Pathak et al, also found a significant decrease (p=0.01) in serum magnesium with the increase in parity. Pregnant women with parity 2 or more had a significantly lower serum magnesium level (1.77±0.35mg/dL) compared to nulliparous pregnant women (2.01±0.57mg/dL)[10]. S Mangalesh et al found no significant correlations between maternal Mg levels and gravidity or parity[14].

This study shows that hypomagnesaemia was seen in 31.8% women with history of past preterm delivery and the risk of hypomagnesmia was significantly high [3.1(1.0395 – 9.6874;p=0.04)]. 18.2% women with hypomagnesaemia had history of abortion in the past [3.2(0.7902 – 13.3205; p=0.1)]. Okunade KS et el in their study observed that the mean serum magnesium level was lower among mothers who had no previous history of abortion than those who had previous history of abortion but the mean difference was not statistically significant whereas the mean serum magnesium level of mothers with previous history of preterm labour was lower than that of those who had no history of preterm labour though the difference was statistically not significant[21].

In present study, 54.5% women with hypomagnesaemia had gestational age <34 weeks and 45.5% women had gestational age ≥34 which is in contrast with study of Axita C et al[22]. They observed of a non-significant reduction in serum Magnesium during the progression of normal pregnancy.

There was a weak positive correlation of magnesium with gestational age which was statistically not significant (r= 0.1301,p=0.1). This is in accordance to the observation made by S Mangalesh et al[14], Okunade KS et al[21] and Rigo J[4] where maternal serum Mg levels were positively correlated with the period of gestation. Mg ions play a significant role in the stabilisation of cellular membranes, and their actions are opposite to that of calcium ions at the molecular level on muscle contraction and nerve impulse conduction. Mg promotes the re-uptake of calcium ions in the sarcoplasmic reticulum of muscle cells, by the calcium-activated ATPase. This leads to a reduced concentration of calcium in the muscle cells. Mg deficiency possibly leads to a low concentration of Mg in the myometrium of the uterus, leading to increased uterine contractility and pre-term labour. Mg has been suggested to act on the uterus in a dose dependent manner, and the inhibitory effect on uterine contractions varies with oxytocin levels[23]. An adequate dietary intake of Mg throughout the duration of pregnancy may, therefore, prove to be a holistic approach to the prevention of pre-term births.

In present study there was a significant but weak negative correlation between serum magnesium and systolic (r= -0.0224; p =0.8) as well as diastolic blood pressure (r = -0.01; p =0.9). The results of present study was in accordance with the results of Kharb S et al[24], Who observed that the correlation between serum Mg at term with pre-eclamptic women was negative and statistically significant (r = −0.219, P = 0.027). Owusu DE et al observed a nonsignificant weak negative correlation between mean arterial pressure and serum magnesium levels in preeclamptic women (r=−0.089; p=0.639)[25].

5. Conclusion

By adequate counselling and improving the socio-economic status of every woman through education and social emancipation will help them to adopt the means to improve their magnesium balance in pregnancy. Determination of Magnesium deficiency in the pregnancy can help in initiating appropriate supplementation and prevention of untoward complications, associated with Magnesium deficiency. Women should be encouraged to consume magnesium rich diet consisting of green leafy vegetables, soy milk, fish and legumes.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

No conflict of interest.

Statement of ethical approval

Ethical approval was taken prior to study.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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