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## RESEARCH ARTICLE

# COMPARATIVE STUDY OF SERUM MAGNESIUM LEVELS IN DIFFERENT TRIMESTERS OF PREGNANCY IN A TERTIARY CARE HOSPITAL

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**ABSTRACT**

Plants Magnesium is very important in health and medicine. Magnesium deficiency affects every system of the body. Magnesium is a crucial element for mediating the vital functions of the nervous and endocrine systems. It helps maintain normal muscle and nerve functions, keeps heart rhythm steady, supports a healthy immune system and keeps bones strong. **Aims and Objectives:** The present study was undertaken: 1. To determine the level of serum magnesium in non-pregnant women of child-bearing age.2 .To determine the level of serum magnesium in pregnant women in different trimesters of pregnancy.3. To compare serum magnesium level of non-pregnant women with serum magnesium level of pregnant women in different trimesters of gestation**. Materials and methods:** The present study was carried out in the Deptt. Of Obstetrics and Gynaecology, Patna Medical College and Hospital, Patna during September2006 to September2008. Estimation of Serum Magnesium Level: by colorimetric method using "Titan Yellow". A significant lowering of the serum magnesium level has been observed on comparing the mean values of first and second trimesters. A significant decline was also noted between the second and third trimesters. The decline in serum magnesium level when comparing the first and third trimester values was highly significant.



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## INTRODUCTION

Magnesium is very important in health and medicine. Magnesium, a macronutrient is a mineral we need fairly large quantities of but have not yet realized its strategic importance. Magnesium deficiency can affect virtually every system of the body. Magnesium absorption and elimination depends on a very large number of variables at least one of which often goes away leading to a magnesium deficiency that can present itself with many signs and symptoms. It is extremely important for the metabolism of Ca, K, P, Zn, Cu, Fe, Na, Pb, Cd, HCl, Acetylcholine and NO, for many enzymes, for the intracellular haemostasis and for activation of Thiamine and therefore for a wide amount of critical body functions. Magnesium is a particularly crucial element for mediating the vital functions of the nervous and endocrine systems. It helps maintain normal muscle and nerve functions, keeps heart rhythm steady, supports a healthy immune system and keeps bones strong. Magnesium also helps regulate blood sugar level, promotes normal blood pressure and is known to be involved in energy metabolism and protein synthesis.

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The enzyme reaction responsible for creation of energy by activating ATP is Magnesium-dependent. The formation of energy rich bonds that require Magnesium constitutes the necessary basis for all cellular activities. Magnesium is essential in regulating central nervous system excitability. Magnesium has a graded effect on central and peripheral nervous system. In adequate doses it acts as CNS deterrant. Significant variation in serum magnesium has been described in various states of pregnancy. During pregnancy growth and development of fetus takes place, it is essential that the internal environment composed of water and electrolyte is maintained and remains stable. Hypomagnesemia in pregnancy has been reported by many workers. The role of hypomagnesemia has remained underestimated in electrolyte balance. But workers rediscovered its importance as a causative factor in abnormal states of pregnancy viz-abortion, premature labour and toxaemia of pregnancy (Seeling, 1980). The diagnosis of low Magnesium level can be confirmed by finding the plasma the plasma magnesium level to be <1.21 mg/100ml. Rasu *et al* (1966) considered serum magnesium level as a parameter for high risk pregnancy including Premature birth. Hurley (1970) observed that serum Magnesium deficiency caused embryonic malformation and even fetal death.

In view of the above studies carried out earlier, the present study was undertaken to observe serum Magnesium level in normal pregnant women in different trimesters of pregnancy and in toxaemia of pregnancy of varying degree to understand and analyze the effect of Magnesium during pregnancy. For correlation serum Magnesium level in non-pregnant women were also observed. Such a study may definitely prove to be of immense value to our women folk.

**Aims and Objectives**

The present study was undertaken:

- To determine the level of serum magnesium in non-pregnant women of child-bearing age.
- To determine the level of serum magnesium in pregnant women in different trimesters of pregnancy.
- To compare serum magnesium level of non-pregnant women with serum magnesium level of pregnant women in different trimesters of gestation.

## MATERIALS AND METHODS

The present study was carried out in the Deptt. Of Obstetrics and Gynaecology, Patna Medical College and Hospital, Patna during September 2006 to September 2008.

**Criteria for diagnosis of Gestational Hypertension**

1.Blood Pressure :SBP >140 mm of Hg and DBP >90 mm of Hg.
2.Proteinuria : >0.3 gm/L in 24-hrs sample.
3.Pitting oedema of at least +1.
4.Weight gain of >= 5 lbs/mth.
5.History of convulsions and fits to diagnose Eclampsia.

**Clinical Procedure**

- A detailed history was taken of each case and a thorough clinical examination was done.
- Routine clinical investigations were carried out.

**Specific Biochemical Examination for Present Study Purpose:**

- Serum Total protein , Albumin , and Globulin
- Serum uric acid
- Serum magnesium level
- Serum Random blood glucose level

**Determination of Serum Magnesium Level:** Estimated by colorimetric method using "Titan Yellow" as described by Neil and Neely (1956).

**Calculation**

Magnesium per 100 ml serum = T – B / S – B *25
(T=Test, B=Blank, S=Standard)

**Selection of cases:** A total of 102 cases were studied.

**1.Control Group:** This comprised of 30 patients who were clinically normal and not pregnant but in the child-bearing age.

**2. Study Group:**Normal pregnant women in different trimesters of gestation.

| Distribution of cases | No. of Subjects |
|---|---|
| NORMAL PREGNANCY:- (Total) | |
| a.First Trimester | 26 |
| b.Second Trimester | 21 |
| c.Third Trimester | 25 |

**Table 1. Serum magnesium level in normal pregnancy and control group: comparative study**

| Group | No. of cases | serum magnesium level in meq/l | | |
|---|---|---|---|---|
| | | Range | Mean | S.d |
| Non-pregnant (control) | 30 | 1.8 - 2.7 | 2.21 | 0.28 |
| Normal pregnant | 72 | 1.5 – 2.3 | 1.94 | 0.23 |

For Control group and Normal Pregnant "p" <0.001 i.e fall in mean serum magnesium levels between the two groups is "significant" statistically.

**Table 2. Serum magnesium level in study group normal pregnancy: different trimesters; pre-eclampsia and eclampsia**

| Groups | No. Of cases | Serum magnesium level in meq/l | | |
|---|---|---|---|---|
| | | Range | Mean | S.d |
| Non-pregnant (control) | 30 | 1.8 - 2.7 | 2.21 | 0.28 |
| 1st trimester | 26 | 1.8 - 2.3 | 2.07 | 0.16 |
| 2nd trimester | 21 | 1.5 - 2.2 | 1.94 | 0.21 |
| 3rd trimester | 25 | 1.5 – 2.1 | 1.79 | 0.21 |
| Pre-eclampsia | 8 | 1.2 - 1.8 | 1.54 | 0.21 |
| Eclampsia | 40 | 0.5 – 1.2 | 0.88 | 0.20 |

**Table 3. Serum magnesium level in non-pregnant (control group) and normal pregnancy (three trimesters): comparative study**

| Groups | Serum magnesium level in meq/l | | | |
|---|---|---|---|---|
| | S.e | " t " | " p " | Significance vs insignificance |
| Non-pregnant vs 1st trimester | 0.063 | 2.21 | < 0.05 | Significant |
| 1st trimester vs 2nd trimester | 0.055 | 2.72 | < 0.05 | Significant |
| 2nd trimester vs 3rd trimester | .064 | 2.34 | <0.05 | Significant |
| 1st trimester vs 3rd trimester | 0.053 | 5.26 | <0.001 | Highly significant |

## DISCUSSION

The Magnesium concentration in serum is closely regulated within the range of 0.7 to 1.0 mmol/L (1.5 to 2.0 mEq/L ,1.7 to 2.4 mg/dl –Harrison). According to Mehta and Chapparwal (Mehta, 1974), the normal mean serum magnesium ranges from 1.0 to 2.2 mEq/L. If plasma concentration of magnesium is less than 1.2 mg/dl (Harrison), it is called hypomagnesemia, a condition which is found frequently in Gestational Hypertension. The magnesium balance in the body is maintained by the physiological phenomenon of absorption, body requirement, and excretion. In healthy subjects the urinary excretion is directly propotional to the magnesium intake. It passes freely through glomerular filtration and is reabsorbed from the tubules in varying degrees. Besides renal disease the serum magnesium is also altered in several conditions such as high intake of calcium decreases the serum level of magnesium. Placental transport of magnesium from maternal serum to that of fetus also seems to decrease the plasma magnesium level. The present work aims at throwing light on the serum magnesium level in different trimesters of normal pregnancy and in toxaemias of pregnancy. The study

group comprised of a total of 120 cases of which 72 cases were normal pregnant women in different trimesters of gestation and 48 cases were patients with toxaemia of pregnancy( 8 cases of pre-eclampsia and 40 cases of eclampsia) .The control group for this study includes normal non-pregnant women in the child-bearing age group. Magnesium is largely an intra-cellular ion and approximately 1% of the total body content of magnesium can be determined by the present day techniques.

The study of magnesium metabolism was much neglected because the estimation of this cation was difficult. Hence, no technique is completely satisfactory. In 1909, McCrudden devised a precipitation method which proved reliable and since then various modifications have been made. In the present study, serum magnesium was determined by colorimetric method using Titan Yellow" as proposed by Neil and Neely (1956). Atomic absorption spectrophotometry is more recent,accurate and sophisticated mehod. The mean serum magnesium level of 72 pregnant women studied in this investigation was 1.94 +- 0.23 S.D mEq/L with a range varying from 1.5 to 2.3 mEq/L (Table 1).Compared to the level of the control group ,this value represents a definite fall in serum magnesium level during pregnancy. These values have been in close conformity with various workers. Mehta and Chapparwal (1974) reported the mean serum concentration to be 1.66 mEq/L in normal pregnant women. Potnis *et al* (1977)[3] reported the non-pregnant magnesium level to be 2.08 mEq/L.

Workers like Rosner and Gorfein (1968)[4] ; Lim *et al* (1969) ; Dale and Simpson (1972)[5] ; Watney *et al* (1964) reported lower serum levels of 1.77 mg% + 0.22 S.D. The difference in serum magnesium levels as reported by various workers maybe due to seasonal variations as stressed by Banerjee (1964). The difference in values could be due to different methods employed by different workers.In the present study not only has the serum magnesium level shown to decrease in pregnancy but there is also a definite and progressive decline in serum magnesium level according to increasing gestational age and lowest values have been seen towards $7^{th}$,$8^{th}$ and $9^{th}$ months (Table 2).The mean serum magnesium values for first ,second and third trimesters were found to be 2.07 mEq/L +- 0.16 S.D, 1.94 +-0.21 S.D and 1.79 mEq/L +- 0.21 S.D respectively. Potnis *et al* found a slight rise in the first trimester upto 2.06 mEq/L. Thereafter continuous fall was observed upto 2.025 mEq/L in the second trimester and 1.874 mEq/L in the third trimester. A significant lowering of the serum magnesium level has been observed on comparing the mean values of first and second trimesters. A significant decline was also noted between the second and third trimesters. The decline in serum magnesium level when comparing the first and third trimester values was highly significant (Table 3). Conflicting reports have been made from time to time in this regard. Lim (1969) found a significant difference only in the third trimester ($p<0.001$) when compared with non-pregnant group. Potnis (1977) considered the fall in the first and third trimesters to be significant but according to him the fall in the second trimester was not significant.

However, Singh (1979) found the gradual fall in the second and third trimester only to be significant. Rizvi *et al*[6] found no significant difference in serum magnesium level upto 18 weeks, there was an insignificant rise upto 36 weeks. Standley *et al* (1997), Spatling L. (1993) found results that provided evidence of decrease in serum magnesium level with increasing gestation during normal pregnancy. Spatling reasoned that this decrease was due to a 25% increase in magnesium excretion. The lowering of serum magnesium was due to hemodilution occurring during pregnancy (De Jorge *et al* 1965; Olatanbosum *et al* (1975). Dale and Simpson (1972) considered it to be the effect of Estrogen.

**Summary and Conclusion**

Serum magnesium level was estimated in normal women in the reproductive phase of life, in normal pregnant women in three trimesters of pregnancy and in women whom pregnancy was complicated by pre-eclampsia or eclampsia. The mean level was found to be lower in pregnant women than in non-pregnant women. There was a progressive fall in serum magnesium level as the period of gestation advanced, and the levels were lowest in the last trimester. The variations observed between normal cases, between different trimesters of pregnancy have been discussed in the light of findings obtained in this study and correlated with observations made by others. This work is an attempt to revisit and reaffirm previous claims by independent workers that serum magnesium level is reduced in pregnancy induced hypertension. To conclude, it would be advisable to recommend additional magnesium supplementation to the pregnant woman to hypomagnesemia with advancement of gestational age, particular attention should be paid to patient developing Gestational Hypertension.

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