

## SERUM MAGNESIUM LEVEL IN ECLAMPTIC PATIENTS IN A TERTIARY CARE HOSPITAL

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### Summary

*Magnesium deficiency during pregnancy has been reported to be associated with eclampsia. This descriptive cross sectional study carried out in Obstetrics and Gynecology Department of Chittagong Medical College Hospital from September 2013 to August 2014. The objective of the study was to estimate the serum magnesium level in eclamptic patients. Serum magnesium level of 80 eclamptic patients and 80 healthy pregnant women (Age and gestational age matched) were measured and compared to evaluate the association between hypomagnesaemia and eclampsia. All the necessary information and clinical data were recorded in predesigned questionnaires and analyzed using SPSS. t-Test and Chi-square test were used for comparison of quantitative and qualitative data respectively. For analytical test the level of significance was 0.05 ('p' value <0.05 was considered significant). Serum magnesium level was found below normal (<1.9mg/dl) in 93.75% eclamptic patients whereas in case of healthy pregnant women 73.75% had serum magnesium level within normal range (1.9-2.5mg/dl). The mean serum magnesium level (1.05±0.29mg/dl) was significantly (p<0.05) lower than the mean serum magnesium level of healthy pregnant women (2.19±0.35mg/dl). Significant difference of serum magnesium level between eclamptic patients and healthy pregnant women recommends that there may have some relationship between hypomagnesemia and development of eclampsia.*

### Key words

Eclampsia; Teenage pregnant woman; Serum magnesium level.

### Introduction

Eclampsia is one of the important causes of maternal and perinatal morbidity and mortality throughout the world. Though the cause of eclampsia is unknown but now a day's eclampsia is considered as malnutrition related disease [1]. Eclampsia is commonly seen in teenage pregnant woman who lives in slum area, devoid of both home care and antenatal care. In Bangladesh, eclampsia accounts 5% of total obstetric admission in our health facilities and 16% of total maternal death [2].

Malnutrition is very common in our country. Pregnancy imposes a great stress on the nutritional reserves. Intake of this essential nutrient in poor income women is far below than recommended daily allowances [3]. There is progressive decline in magnesium consumption from 475-500 mg/day in 1900-1908 to 175-225 mg/day in 1990-2002 due to widespread consumption of processed foods and decreased consumption of fresh foods [4]. Nuts and green leafy vegetables are good sources of magnesium [5].

It has been demonstrated that magnesium is essential for life. Magnesium is the second most abundant intracellular cation and fourth most abundant cation in the body that must be kept in balance in extra cellular fluid to regulate all body functions that require ATP [6,7]. Over 300 enzymes are dependent on magnesium.

The principal clinical features attributed to magnesium deficiency are irritability, tetany, hyperreflexia, and occasionally hyporeflexia [8]. Serum magnesium level is tightly regulated in a narrow range of approximately 0.7 to 1.0 mmol/l, because only 01% of the total body content of magnesium is extracellular [6]. Magnesium deficiency is regarded when serum ionized magnesium level falls below 0.7 mmol/l although patients remain asymptomatic [6]. Symptoms

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appear when level falls below 0.5 mmol/l [6]. Statistically significant fall in serum magnesium has been observed in eclampsia. Administrations of magnesium sulfate to these patients were beneficial in relieving severity of the disease [9]. One study showed that abnormally low concentration of ionized magnesium in the serum is responsible for eclamptic convulsion [2].

Magnesium deficiency during pregnancy has been reported to be associated with eclampsia, pre-eclampsia, preterm birth, increased maternal hospitalization, incidence of low birth weight and small for gestational age infants [10]. So, there is a relationship between the low level of serum magnesium of pregnant women and the development of eclampsia. Supplementation of these elements to diet may be of value to prevent eclampsia. Oral magnesium supplementation during pregnancy improves the maternal morbidity and mortality and also improves the fetal outcome [10].

#### **Materials and methods**

This descriptive cross sectional study was conducted in Obstetrics and Gynecology Department of Chittagong Medical College Hospital from September 2013 to August 2014. The study included age (18 – 40 years) and gestational age (37 completed weeks) matched 80 eclamptic and 80 healthy pregnant women considering the inclusion and exclusion criteria to compare the serum magnesium level between these two groups. Eclamptic patients having prior treatment, oliguria, history of ischemic heart disease and epilepsy were excluded from this study. The study was approved by the Institutional Review Board and also by the Ethical Review Committee of Chittagong Medical College, Chittagong. All aspects including confidentiality and right not to participate were duly considered. Informed written consent was obtained from legal guardians of eclamptic patients and healthy pregnant women. From each eclamptic patient and healthy pregnant woman 5 ml of venous blood was collected using sterile disposable plastic syringe by antecubital venipuncture, taking full aseptic precaution and poured into a clean glass test tube. Blood sample was preserved at room temperature. Venous blood used for measurements of serum magnesium was drawn into plain non-siliconized 4.5 ml tubes. After clotting (45 minutes) and centrifugation (10 minutes) serum

was separated from the cells and stored at -20°C in a completely filled rubber sealed air tight tube. Serum Magnesium level of all the samples were tested by using Evolution 3000 Biochemistry Analyzer. Normal serum magnesium level is 1.9 to 2.5 mg/dl and <1.9 mg/dl considered as hypomagnesemia [11]. All the necessary information and clinical data from each of the study patients were collected and recorded systematically in a predesigned questionnaire. Data were compiled, checked and edited. Data processing and analysis was done with the help of computer using statistical software SPSS (Statistical Package for Social Sciences) Vs 16 for Windows. t-test was used for comparison of data presented in quantitative scale and Chi-square test for comparison of data presented in categorical scale. Qualitative comparison is presented as Percentage whereas quantitative comparison is presented as Mean±SD. For any analytical test the level of significance is 0.05 and 'p' value <0.05 was considered significant.

#### **Results**

The study included 80 eclamptic patients of 37 completed weeks without having prior treatment. Age and gestational age matched (18 – 40 years), 80 healthy pregnant women also included in this study to compare the serum magnesium level between these two groups.

In case of eclamptic patients, maximum 43.75% patients were belonged to 20 years of age group. On the other hand, in case of healthy pregnant women, maximum 36.25% patients were belonged to 21-25 years of age group. The mean age was found 23.51±5.44 years in eclamptic patients and 24.79±4.48 years in healthy pregnant women. The mean age difference was not statistically significant ( $p>0.05$ ) between two groups. 60.00% of eclamptic patients were primi gravida and 40.00% patients had multi gravida. In healthy pregnant women group, 62.50% patients were multi gravida and 37.50% patients had primi gravida. The mean gravidity was found 1.81±1.25 in eclamptic patients group and 2.19±1.20 in healthy pregnant women group. The gravidity difference was statistically significant ( $p<0.05$ ) between two groups. It was observed that, 93.75% eclamptic patients had pretreatment serum magnesium level below normal limit (<1.9 mg/dl). Whereas, in healthy pregnant women 73.75% had

serum magnesium level within normal limit (1.9-2.5 mg/dl). The mean serum magnesium level was found 1.05±0.29 mg/dl in eclamptic patients and 2.19±0.35 mg/dl in healthy pregnant women. The mean serum magnesium level was statistically significant (p<0.05) between two groups. In case of eclamptic patients 85.00% patients belonged to monthly family income range of taka 6,000-10,000 which is the maximum quantity of this group. In healthy pregnant women 67.50% patients in the same income range. The mean monthly family income was found Taka 8187.50±2008.50 in eclamptic patients and Taka 10244.00±3064.70 taka in healthy pregnant women. The difference was statistically significant (p<0.05) between two groups. Regarding antenatal visits of the study groups, 52.5% eclamptic patients got 1 to 2 antenatal checkup (ANC) 32.5% had no ANC. In case of healthy pregnant women 50% got 1-2 ANC and 11.25% had no ANC. The mean antenatal (ANC) checkup was found 1.41±1.19 in eclamptic patients and 2.24±1.09 in healthy pregnant women. The antenatal visit was statistically significant (p<0.05) between two groups.

**Table I :** Distribution of the study population by age

Age (in years)	Eclamptic patients (n=80)		Healthy pregnant women (n=80)		p value *
	n	%	n	%	
< 20	35	43.75	20	25.00	
21-25	27	33.75	29	36.25	
26-30	9	11.25	22	27.50	
31-35	6	7.50	9	11.25	
36-40	3	3.75	0	0.00	
Mean ± SD	23.51 ± 5.44		24.79 ± 4.48		0.106ns **
Range (Min, max)	18, 40		18, 35		

**Table II :** Distribution of the study population by gravidity

Gravidity	Eclamptic patients (n=80)		Healthy pregnant women (n=80)		p value *
	n	%	n	%	
Primi	48	60.00	30	37.50	
Multi	32	40.00	50	62.50	
Mean ± SD	1.81 ± 1.25		2.19 ± 1.20		0.045s ***
Range (Min, max)	1, 6		1, 5		

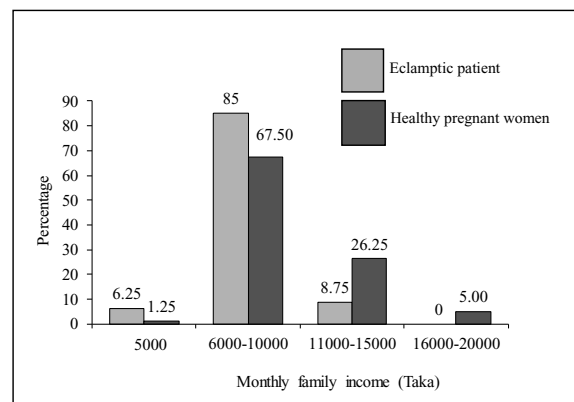
**Table II I:** Comparison of Serum Magnesium Levels between eclamptic patients and healthy pregnant women

Serum magnesium level (mg/dl)	Eclamptic patients (n = 80)		Healthy pregnant women (n = 80)		p value *
	n	%	n	%	
Below normal (<1.9)	75	93.75	11	13.75	
Normal (1.9-2.5)	5	6.25	59	73.75	
Above normal (>2.5)	0	0.00	10	12.50	
Mean ± SD	1.05 ± 0.29		2.19 ± 0.35		0.001s ***
Range (Min, max)	0.7, 2.0		1.4, 3.2		

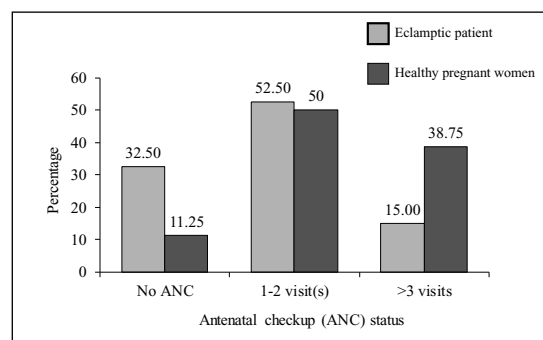
\* p value reached from unpaired t-test

\*\* ns = not significance

\*\*\* s = significant



**Figure 1 :** Bar diagram showing monthly family income



**Figure 2 :** Bar diagram showing antenatal checkup of eclamptic patients

**Discussion**

A total of 160 pregnant women were studied. Among them 80 were eclamptic and 80 normal pregnant women. In this study serum magnesium level was found below normal (<1.9mg/dl) in 93.75% eclamptic patients whereas in case of healthy women 73.75% had serum magnesium

within normal range (1.9-2.5mg/dl). The mean serum magnesium level was found  $1.05\pm 0.29$  mg/dl in eclamptic patients and  $2.19\pm 0.35$  mg/dl in healthy pregnant women. The mean serum magnesium level was statistically significant ( $p<0.05$ ) between two groups. It supports the results of previous studies. In a study conducted in BSMMU (Bangabandhu Sheikh Mujib Medical University) the pretreatment magnesium level of eclamptic patient was significantly lower than normal pregnant women [11]. Another study conducted in DMCH (Dhaka Medical College Hospital) reported that abnormally low concentration of serum magnesium is responsible for eclamptic convulsion [2]. Statistically significant fall ( $p<0.05$ ) in serum magnesium has been observed in eclampsia patients in different studies [9,12]. In another study, it was observed that there was extracellular calcium and magnesium reduction in patients with eclampsia and this reduction may have a cause and effect relationship with the disorder [13].

Magnesium is the second most abundant intracellular cation and the fourth most abundant cation in the body which is essential for life. The cut off value of serum magnesium is taken as 1.763 with sensitivity of 85%, specificity of 90% and diagnostic efficiency of 86%. Abnormally low concentration of magnesium is found in the serum of the eclampsia patients and it is the possible independent determinant factor for developing eclampsia. So, estimation of serum magnesium of pregnant women during antenatal period should be done to detect high risk group and thereby to prevent eclampsia. Oral magnesium preparations should be supplemented during pre-pregnancy or early pregnancy for prevention of eclampsia.

In this study, it was observed that maximum (43.75%) eclamptic patients belonged to 20 years of age group whereas most healthy pregnant women (36.25%) belonged to 21-25 years' age group. The mean age was found  $23.51\pm 5.44$  years, varied from 18 to 40 years and  $24.79\pm 4.48$  years varied from 18-35 age groups in eclamptic and healthy women respectively, which were almost similar between two groups. A study showed the mean age was  $25.35\pm 6.19$  years in case group and  $25.33\pm 4.27$  years in control group, the difference was not statistically significant [12]. Similarly, in other study it was found that the mean age was  $28.3\pm 4.69$  years in case group and  $27.2\pm 4.5$  years

in control group consisted of eclamptic patients and healthy women respectively [14]. The median age of the participant eclamptic women is 21 (17-34) years [2]. 48% of them are less than 20 years old, 42% belong to age group 21-30 years and only 10% belong to age group 31-35 years [2]. Mean age  $25.83\pm 5.69$  years in eclamptic patients' group and  $25.84\pm 5.43$  years in normal pregnancy group were found in another study which are closely resembled with the result of present study [15]. All the above findings support that eclampsia is commonly seen in younger population.

In this study, it was observed that 85.0% eclamptic patients belonged to monthly income range of Tk 6,000-10,000, which is the maximum quantity of this group. In healthy pregnant women group 67.5% were in the same income range. The mean monthly income was Tk  $8187.50\pm 2008.50$  and Tk  $10244.00\pm 3064.70$  in eclamptic and healthy pregnant women respectively. The monthly income was statistically higher ( $p<0.05$ ) in healthy group. This result is consistent with previous studies. In our country, mean monthly income Taka  $3500.00\pm 95.00$  in Case group and Taka  $7500.00\pm 250.00$  in Control group was observed in a study [12]. The difference was statistically significant. In 90.0% cases have monthly income less than Taka 3500 was found in a study conducted on 2009 [2]. There is evidence that, 90% eclampsia seen in poor, under privileged, malnourished, illiterate younger women who lived in urban slum or remote areas devoid of health care facility.

The study showed that in case of eclamptic patients, 60% patients were primi and 40% patients were multi gravida and in healthy pregnant women 62.5% patients were multi gravida and 37.5% women were primi. The mean gravidity was  $1.81\pm 1.25$  and  $2.19\pm 1.20$  in eclamptic patients and healthy pregnant women respectively which was found significantly ( $p<0.05$ ) higher in healthy group of people. The result is similar to previous studies. Those studies showed 72-80% of their eclamptic patients were primi gravida [2,16,17,18]. All are consistent with the current study.

The study showed, 52.50% of eclamptic patients and 50% of healthy pregnant women received 1 ~ 2 antenatal visits. Almost one third (32.50%) of eclampsia patients didn't receive any antenatal checkup. The mean antenatal visit was found  $1.41 \pm 1.19$  and  $2.24 \pm 1.09$  in eclamptic and healthy group of people respectively. The number of antenatal visits were significantly ( $p < 0.05$ ) higher in healthy study group. Statistically significant difference between case and control group regarding antenatal care (ANC) observed in a study, where 82% of the study group had no ANC [12]. Similarly, in a previous study, it was observed that 72% of the study group had no ANC [2]. The finding of another study was that only 2.3% women end their pregnancy under medical supervision (whether it be abortion or delivery); the rest have no access to obstetric care [19]. As most of the eclamptic patients are born in rural areas and belong to a lower social class, most of them might never receive any antenatal care. These findings are compatible with other studies [20,21]. Ante partum care identifies risk factors and complications and rectifies it. In our country, only 20% women received regular ANC and 40% have no ANC [2].

In women with eclampsia, magnesium deficiency is suspected. If pregnancy remain uncared, women have no ANC, decreased dietary supply of proteins, vitamins and minerals, low maternal age, low income, low quality of life, these leads to severe micronutrient deficiency particularly magnesium deficiency that causes tissue hyperirritability and convulsion.

From above discussion, it is found that, there is significant difference between serum magnesium level between eclamptic and healthy pregnant women. It can be assumed that hypomagnesaemia may have some association with development of eclampsia and thus it may satisfy the research question of this study.

#### **Limitations of the study**

The study population was selected from one selected hospital in Chittagong city, so that the results of the study may not reflect the exact picture of the country. The present study was conducted at a very short period of time. Small sample size was also a limitation of the present study. Financial hardship was also faced during the progress of the study.

#### **Recommendation**

The result of present study supports that hypomagnesaemia may be a possible etiology of eclampsia. Magnesium enriched diet or oral supplementation of magnesium during pregnancy may be of value to prevent eclampsia. However, in order to increase confidence in these findings large scale multi centric prospective longitudinal study of pregnant population with or without magnesium supplementation by diet or drug is necessary in different regions of the country.

#### **Conclusion**

Significant difference of serum magnesium level between eclamptic and healthy pregnant women recommends that there may have some relationship between hypomagnesaemia and development of eclampsia.

#### **Disclosure**

All the authors declared no competing interest.

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