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Observation the Serum Magnesium Level During Second and Third Trimester Pregnant Women

Tawfeg A. Elhisadi[1]*, Akrahm M. Saleh Habil[2], Azza M. Mohamed[3]

[1,3] Department of Public Health, College of Medical Technology, Derna, Libya
[2] Department of Laboratory Medicine, College of Medical Technology, Derna, Libya

*Corresponding author: *drelhisadi@yahoo.com*

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Abstract:
Magnesium is one of the major electrolytes; Magnesium deficiency is common, especially among pregnant women which plays an important role in pregnancy for the formation of new tissues and for cell multiplication in a growing fetus and frequently overlooked in critical illness, leading to an adverse clinical outcome if not monitored regularly particularly in pregnant women. This study was conducted to observe the serum magnesium level during pregnancy because magnesium deficiency in pregnant women will leads to life threatening complications for mother as well as their babies. This observational study was conducted in the department of gynecology, Al Wahda Hospital. Derna, Libya. The inclusion criteria of the study were pregnant women with 20-46 years of age, had second and third trimester of pregnancy. The informed consent was taken from all participants participated in the study and the grouping was made according to serum magnesium level, trimester of pregnancy. The blood sample collected for serum Magnesium level and sent to laboratory for analysis. The data was analyzed in SPSS version 11.00. Total of 50 patients were selected in this study. We have observed high prevalence of hypomagnesemia 44 % among pregnant women in second and third trimester. Moreover, we found no association between serum magnesium levels and the subsequent development of hypertension during the pregnancy, as a result of non-significant $p > 0.05$. However, there are mild significant direct correlation of hypomagnesemia with hypotension but this relationship illogical and this hypotension due to other courses and most previous studies as we too suspect hypomagnesemia may lead to hypertension.

Keyword: Hypomagnesemia, Hypertension, Hypotension, Magnesium, Mypermagnesemia.

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INTRODUCTION

Magnesium is a chemical element with a symbol of Mg++, atomic number 12 and atomic mass 24.3. The name Thessaly. Magnesium was discovered about the same time as aluminum. Sir Humphrey Davy, the great British [Cornish] chemist, first isolated aluminum in 1807 and discovered magnesium in 1808. Signs and symptoms of magnesium deficiency include fatigue, confusion irritability, weakness and hypertension, loss of appetite insomnia, nausea, vomiting, diarrhea, defect in nerve conduction and muscle contraction [1].

The magnesium plays an important role in the structure and function of the body and is essential to good health. Approximately 50% of total body magnesium is found in bones and the other half is found predominantly inside cells of body tissues and organs. Only 1% of magnesium is found in blood, but the body works very hard to keep blood levels of magnesium constant [2]. Magnesium deficiency is common, especially among women, the elderly,

and minorities, it has been postulated that hypomagnesemia contributes to the development of hypertension and cardiovascular disease (CVD) [3&4].

High blood pressure during pregnancy is a risk factor for developing preeclampsia (PE) and eclampsia (E) and affects approximately 6–8% of all pregnant women. High blood pressure during pregnancy accompanied by proteinuria of at least 0.3g/day, it is defined as preeclampsia (PE). PE can be complicated by elevated liver enzymes, low platelets, or changes in the coagulation system, which are life-threatening conditions. PE can further lead to general convulsions, called Eclampsia. (E), for which the only known as condition of seizures carrying a high maternal and fetal mortalit [5,6]. In experimental studies, magnesium has been shown to participate in the regulation of vascular tone, endothelial function, vascular inflammation, and glucose and lipid metabolism Magnesium deficiency raises blood pressure in animal models whereas magnesium supplementation prevents the development of hypertension in these models. Furthermore, in mouse models, higher levels of dietary magnesium have been found to suppress atherogenesis [7].

Evidence suggests that Vitamins and minerals supplementation or eating patterns that include relatively high intakes of fruit, vegetables, nuts, and whole grains are associated with significant lower risk of many health problems such as anemia, neural tube defects, and osteoporosis, heart disease, cancer and stroke [8,9]. Magnesium has numerous physiological functions in the body in health as in disease With regard to muscle function; magnesium affects oxygen uptake, energy production and electrolyte balance. The adult human body contains about 25 grams of magnesium. Over 60% of all the magnesium in the body is found in the skeleton, about 27% in muscle, while 6 to 7% is found in other cells and less than 1% is found outside cells. Magnesium is involved in more than 300 essential metabolic reactions [10,11]. Essential minerals or the use of magnesium supplements, are recommended to enhance performance. Athletes usually consume sufficient minerals, including magnesium by high energy diets] 12, 13].

Magnesium plays an important role in pregnancy for the formation of new tissues and for cell multiplication in a growing fetus and is an essential element of life chemistry in keeping a balanced neuro muscular system. Therefore, pregnant women require higher magnesium intake than non-pregnant women of same age. Magnesium plays an important role during pregnancy for the formation of new tissues (maternal and fetal). Pregnant women require higher magnesium intake than the normal non-pregnant women of same age [14,15,16]. Mg deficiency in pregnant women compared with non-pregnant women, they found that both total and ionized magnesium were significantly lower during normal pregnancy [17].

Many previous studies reveal that, pregnant women tend to have low blood magnesium level than non-pregnant because of increase demand for mother and growing fetus and increase renal excretion of magnesium 25% more than non-pregnant women due to increase in GFR and haemodilution in 2nd regenancy women due to increase in GFR and haemodilution in 2nd regnancy may cause hypertension [18]. Hypomagnesaemia can be defined as serum magnesium concentrations less than 1.6 mg/dL. Hereditary factors, poor dietary intake, autonomic dysfunction, altered insulin metabolism, glomerular hyperfiltration, osmotic diuresis, recurrent metabolic acidosis, hypophosphataemia and hypokalaemia may all contribute to hypomagnesaemia in diabetic patients [19]. Moreover, investigators reported that doses of anti-hypertensive drugs needed to be higher in patients with a magnesium deficiency than in those without [20]. Serum total magnesium levels are a good marker of magnesium status, because they correlate with ionized magnesium and intracellular magnesium and demonstrate low intra-individual and temporal variability [21].

Materials and methods

Sample collection and Patient characteristics

This observational study was conducted in Al Wahda Hospital. Derna, Libya. The pregnant women visiting gynecology outpatient department (OPD), women with 20-46 years of age, had two and three trimester of pregnancy and willing for follow-up. The exclusion criteria of the study were; women, 1 trimester of pregnancy, history of primary hypertension (essential), known diabetics, anemia (moderate and severe), tuberculosis, cardiac disease, multiple pregnancy (Twin, Triplet), less than 20 years and more than 46 years of age, patients with acute pancreatitis, patients with history of diarrhea, vomiting and nasogastric suction, patients on Diuretics.

The informed consent was taken from all participants participated in the study and the grouping was made according to serum magnesium level, trimester of pregnancy and age of women. The data were collected on the preformed questionnaire. The questionnaire comprised of sections to elicit the information regarding the general bio-data of the patient as well as specific information. The section of specific information comprised of patients weight, height, waist circumference and body mass index (BMI) during pregnancy, blood pressure recording with diabetic state and serum magnesium level.

After taking detailed history, clinical examination, about 2 ml of venous blood was collected for serum separation. The blood was collected in red top vacutainers and made to stand for 30 min until centrifugation on 3000 rpm in a centrifuge for 5 minutes. The clear upper layer of serum was isolated and sent to laboratory for analysis.

Procedure and principle

Serum magnesium was estimated by an end-point colorimetric method by Xylidyl blue magnesium fluid monoreagent (Centronic GmbH-Germany), a colorimetric endpoint method.

Briefly, 10 µL of each serum sample were added to 1000 µL of Xylidyl blue magnesium fluid monoreagent, then mix the contents and incubated at 25°C for 5 min. The colored complex formed by magnesium with the monoreagent was read on a spectrophotometer in 1 ml cuvettes at 545 nm against reagent blank, and is proportional to the concentration of magnesium present in the sample. The results were expressed as mg/dl.

The method is based on the reaction of serum magnesium with xylidyl blue in alkaline solution containing GEDTA (Glycol Ether Diamine Tetra Acetic acid) to prevent the Calcium interference in the sample.

Interpretation

Normal range for magnesium concentration in our laboratory was 1.70-2.55 mg/dl. Subjects were divided into normomagnesemia and hypomagnesemia groups and compared for various parameters. Serum magnesium level of <1.70 mg/dl was regarded as hypomagnesemia and ≥2.56 mg/dl as hypermagnesemia

Statistical analysis

The data and information obtained from this study was processed using statistical package for social science (SPSS) computer software version 11, frequency tables were made and results tested for statistical significance using the student t-test and chi-square test. The significant value is put at $p < 0.05$.

Result and discussion

Total 50 patients were selected in this study, the age of patients were from 20 to 46 years old, with mean 28.31years old (± SD 6.74) in group of second trimester and 31.35 years old (± SD 5.40) in group of third trimester as shown in table 1&2.

Table 1: Descriptive Statistics in Second of trimester women

Parameter	N	Minimum	Maximum	Mean	Std. Deviation
Age	19	20.00	46.00	28.31	6.74
weight	19	37.30	104.30	70.30	18.21
Height	19	149.00	175.00	157.21	7.83
BMI	19	13.70	43.10	28.68	8.12
Mg level	19	1.00	2.60	1.70	0.43

Table 2: Descriptive Statistics in Group of third trimester

Parameter	N	Minimum	Maximum	Mean	Std. Deviation
Age	31	21.00	42.00	31.35	5.40
Weight	31	55.90	121.30	83.35	17.02
Height	31	146.00	175.00	159.64	7.83
BMI	31	22.63	44.55	32.57	5.55
Mg level	31	0.90	2.50	1.71	0.47

In this study, all 50 pregnant women divided into three groups according to recorded blood pressure. low blood pressure (36%), normal blood pressure (48%), and high blood pressure (16%), as shown in table 3.

Table 3: Interpretation of recorded blood pressure for 50 pregnant women

Blood pressure	Frequency	Percent	Valid Percent
hypotension	18	36.0	36.0
Normal BP	24	48.0	48.0
hypertension	8	16.0	16.0
Total	50	100.0	100.0

The results in this study collected into two groups according to magnesium concentration. The first have low magnesium concentration (hypomagnesemia) and the other have normal magnesium concentration as shown in table 4.

Table 4: Magnesium Frequency and Percentage of hypomagnesemia

	Frequency	Percent	Valid Percent
hypomagnesemia	22	44.0	44.0
Normal Mg	28	56.0	56.0
Total	50	100.0	100.0

The mean value of magnesium concentration was normal for both groups with mean of 1.7 mg/dl (±SD 0.45). The range of observed values for magnesium was 1.0-2.60 mg/dl in second trimester group as shown in table 1, and the mean value was observed between 0.9-2.5 mg/dl in third trimester group as shown in table 2.

The number of participants pregnant women with a serum magnesium <1.7 mg/dl was 44%, while the number of participants with a serum magnesium within normal range was 56% as shown in Table 4.

The results revealed that 30% of pregnant women had normal blood pressure with normal magnesium level. In addition to 18% of pregnant women had normal blood pressure with hypomagnesemia as shown in table 5.

The study showed that 14% of pregnant women had normal magnesium level with hypotension, while 22% of pregnant women had hypotension with hypomagnesemia

Chi-Square Tests reveal 0.205 of Fisher's Exact Test which validate the small sample size as shown in table 6. The results in this study illustrated the Symmetric Measures by Spearman Correlation of our study, which has shown non-significant correlation of estimated P value 0.062, as shown in table 7.

Table 5: Correlation blood pressure and Mg concentration

Mg Concentration,	blood pressure			Total
	hypotension	normal	hypertension	
hypomagnesemia	11 (22%)	9 (18%)	2 (4%)	22 (44%)
Normal Mg level	7 (14%)	15 (30%)	6 (12%)	28 (56%)
Total	18 (36%)	24 (48%)	8 (16%)	50 (100%)

Table 6: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	3.722a	2	.155	.205		
Likelihood Ratio	3.784	2	.151	.205		
Fisher's Exact Test	3.556			**.205**		
Linear-by-Linear Association	3.507b	1	.061	.068	.046	.029
N of Valid Cases	50					

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 3.52.
b. The standardized statistic is 1.873.

Table 7: Symmetric Measures

		Value	Asymp. Std. Errora	Approx. Tb	Approx. Sig.	Exact Sig.
Interval by Interval	Pearson's R	.268	.132	1.923	.060c	.068
Ordinal by Ordinal	Spearman Correlation	.271	.133	1.953	.057c	**.062**
N of Valid Cases		50				

a. Not assuming the null hypothesis.
b. Using the asymptotic standard error assuming the null hypothesis.
c. Based on normal approximation.

In pregnancy, micronutrients including magnesium are important for normal growth and development of baby. Deficiency of magnesium in mothers can affect not only the health of mother but their babies too. The formation of new tissue (maternal and fetal) during pregnancy requires high magnesium intakes than that of the normal non-pregnant women of comparable age. The magnesium deficiency in pregnant women is an important risk factor for the complications that can be prevented by timely detection and proper management. This observational study was observed high prevalence of hypomagnesemia 44 % among pregnant women

We found no association between serum magnesium levels and the subsequent development of hypertension, because of non-significant p value 0.062; however, there are mild significant direct correlation of hypomagnesemia with hypotension but this relationship not logical and this hypotension due to other courses and most previous studies as we too suspect inverse correlation

Only a few studies have examined the relationship between serum magnesium and hypertension. Our findings are in contrast to many previous studies that have related hypomagnesemia to hypertension, their experimental data reveal a role for magnesium in the pathogenesis of hypertension [22]. On other hand, our finding supporting other previous studies revealed lack of the association between serum magnesium and incident hypertension [23].

CONCLUSION

The results in this study revealed that high prevalence of hypomagnesemia represented 44 % among pregnant women, but no statistical significant (p >0.05), with development of hypertension. The range of observed values for magnesium was 1.0-2.60 mg/dl in second trimester group, and the mean value was observed between 0.9-2.5 mg/dl in third trimester group. The results showed that 30% of pregnant women had normal blood pressure with normal magnesium level. In addition to 18% of pregnant women had normal blood pressure with hypomagnesemia. The study showed that 14% of pregnant women had normal magnesium level with hypotension, from other hand, 22% of pregnant women had hypotension with hypomagnesemia. The study support that magnesium supplementation is important during the pregnancy as a result of high rate of hypomagnesemia during the pregnancy for prevention of pregnancy associated complications.

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