

## Circulating magnesium & Acute phase inflammatory reactant in North Indian adult population

Geeta Shamnani<sup>\*1</sup>, Vani Gupta<sup>2</sup>, Charushilla Atul Rukadikar<sup>3</sup>, Shraddha Singh<sup>4</sup>, Sunita Tiwari<sup>5</sup> and Shekhawat Singh Bharti<sup>6</sup>

<sup>1</sup>Assistant Professor, Department of Physiology, RKDF MCH & RC, Bhopal, MP, India

<sup>2</sup>Professor, Department of Physiology, King George's Medical University, Lucknow, UP, India

<sup>3</sup>Assistant Professor, Department of Physiology, CMC & Hospital, Bhopal, MP, India

<sup>4</sup>Professor, Department of Physiology, King George's Medical University, Lucknow, UP, India

<sup>5</sup>Professor, Department of Physiology, King George's Medical University, Lucknow, UP, India

<sup>6</sup>SMO, World Health Organization

QR Code



### \*Correspondence Info:

Dr. Charushilla Atul Rukadikar

Assistant Professor

Department of Physiology

Chirayu medical college and Hospital, Bhopal (MP), India

### \*Article History:

**Received:** 24/04/2018

**Revised:** 29/04/2018

**Accepted:** 29/04/2018

**DOI:** <https://doi.org/10.7439/ijbar.v9i4.4762>

### Abstract

**Background:** The increase of several serum proteins named acute phase reactants is a feature of the tissue response to inflammation. C-reactive protein (CRP) is one of the most sensitive acute-phase reactants in humans. Magnesium is found to be associated with these inflammatory reactants in previous studies.

**Objectives:** The aim of this study was to investigate the relationship between serum magnesium levels and C-reactive protein in apparently healthy adults.

**Methods and material:** This is a population based cross-sectional study. Total 130 adults of age between 25-65 years, were recruited with prior ethical approval and with written informed consent.

**Result:** Mean value of serum magnesium was found to be 2.01mg/dl ( $\pm 0.29$ ) with range between 1.4mg/dl to 2.9mg/dl. Not a single case of severe hypomagnesemia ( $< 1.2$  mg/dl) was found. Serum magnesium was found to have no significant correlation with C-reactive protein ( $r = -0.12, p=0.23$ ).

**Conclusion:** Authors report no significant co-relation between serum magnesium and CRP. Further larger studies are required to be done.

**Keywords:** Circulating magnesium, acute phase inflammatory reactants, cross-sectional study, hypomagnesemia, C-reactive protein, North Indian adult population.

### 1. Introduction

Inflammation has been associated with many chronic conditions, such as cancer, cardiovascular disease, obesity, and insulin resistance. It is also an important cardiovascular risk factor. Magnesium is an essential, mainly intracellular, cation that has been favourably associated with markers of inflammation and endothelial dysfunction [1,2] and risk of the metabolic syndrome [3,4] and type 2 diabetes [5,6]. Despite these promising data, prospective studies on magnesium intake and risk of ischemic heart disease [4] have yielded inconsistent results, with some studies showing null [7,8] or nonindependent associations [9] and others a weak inverse association [10-

12]. Hypomagnesaemia was defined as serum magnesium concentrations  $\leq 1.8$  mg/dL [ $\leq 0.74$  mmol/L] [13]. Recommended dietary allowance (RDA) of the magnesium is 420 milligrams per day for adult male and 320 milligrams per day for adult female [14]. However, magnesium intake is falling due to increase consumption of processed and fast food. Thus, the incidence of chronic magnesium deficiency is probably increasing, with possible health hazards, but is not recognized because of the diagnostic limitations of magnesium status [15, 16].

Most of the previous studies were performed in diabetic, hypertensive, coronary heart disease, eclampsia patients to find role of magnesium in inflammation.

Moreover there are limited studies are available in North India. Therefore this study is designed to find out correlation between fasting serum magnesium and cardiometabolic risk factors in North Indian apparently healthy adults.

## 2. Material and Method

### 2.1. Ethical statement and subject recruitment

This is a cross-sectional study conducted in north Indian adults irrespective of sex with age between 25 and 65 years. We enrolled 130 apparently healthy adults for this study, of which 67(51.5%) were males and 63(48.5%) were females. A structured proforma was filled to collect the information regarding their medical, personal, family, and dietary history. This study was approved by the ethical committee of our institute and “we certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during this research.” Written informed consent was obtained from all the volunteers.

Subjects with pregnancy, history of alcohol consumption or cigarette smoking, history of any known cardiovascular disease, diabetes mellitus type 1 and 2, endocrinal disorders, metabolic disorders, hypertension, renal diseases, psychosomatic disorder neurological disorders were exclude from study because all these conditions may affect serum magnesium value. Subjects with history of intake of lipid lowering drugs, diuretics, cisplatin or any other medication which affect magnesium absorption, metabolism or excretion were excluded from study. However subjects with recent or chronic infections were not excluded from study. All samples were collected from Lucknow and nearby areas.

### 2.2. Biochemical analysis

Blood samples for biochemical parameters were collected from subjects in the morning having 12 hours of overnight fast. Sample was centrifuged and serum separated for estimation of C-reactive protein and serum magnesium level.

#### Determination of C- reactive protein:

The VITROS CRP slide method was performed using the VITROS CRP slides. Microslide technology was used on Vitros 250 fully autoanalyzer

#### Estimation of serum magnesium level:

The VITRIOS Mg Slide method was used. Test type was colormetric using fully autoanalyzer.

### 2.3. Statistical analysis

All the clinical data and anthropometric values are presented as mean  $\pm$  SD. All the analysis was carried out by using SPSS 16.0 version (Chicago, Inc., USA). The Pearson Correlation Coefficient was calculated to find the direction of association between two continuous parameters. The linear regression analysis was applied to find the strength of the associations. For all analyses, *P* value < 0.05 was considered as statistically significant.

IJBAR (2018) 09 (04)

## 3. Results

Gender distribution of the subjects is given in Table-1. Distribution of all the biochemical parameters with mean and standard deviation are given in the table-2. Correlation of serum magnesium with C-reactive protein is given in table-3. Serum magnesium was found to have no significant co-relation with C-reactive protein ( $r = -0.12$ ,  $p=0.23$ ).

**Table 1: Gender distribution of the subjects**

Gender	No. (n=130)	%
Male	67	51.5
Female	63	48.5

Total number of subjects was 130 of which 67(51.5%) were males and 63(48.5%) were females.

**Table 2: Distribution of biochemical parameters**

Biochemical parameters	Mean $\pm$ SD	Minimum	Maximum
C-reactive protein (mg/L)	4.78 $\pm$ 4.83	0.5	21
Serum Mg (mg/dl)	2.01 $\pm$ 0.29	1.4	2.9

Mean value of C-reactive protein was found to be 4.78mg/L ( $\pm 4.83$ ) with range between 0.5mg/L to 21mg/L. Mean value of serum magnesium was found to be 2.01mg/dl ( $\pm 0.29$ ) with range between 1.4mg/dl to 2.9mg/dl.

**Table 3: Correlation of serum Mg with C-reactive protein**

Lipid profile	Serum magnesium	
	Correlation coefficient ( $r^1$ )	p-value
C-reactive protein (mg/L)	-0.12	0.23

<sup>1</sup>Spearman correlation \*Significant ( $p < 0.05$ )

Serum magnesium was found to have insignificant negative co-relation with C-reactive protein ( $r = -0.12$ ,  $p=0.23$ ).

## 4. Discussion

Co-relation of serum magnesium with C-reactive protein was found to be insignificant ( $r = -0.12$ ,  $p=0.23$ ) in this study. Result of this study was in contrast to most of the previous studies. A number of studies have emphasized a potential relationship between serum magnesium and C-reactive protein. These studies were performed in the heart failure patients [17], patients undergoing elective cardiac surgery with cardiopulmonary bypass [18], in patients with acute ischemic stroke and acute infections [19]. While this study was performed in apparently healthy individuals, in whom inflammatory marker [C-reactive protein] was not much deranged. A study [20] performed in US reported that adults >17yrs who consumed less than RDA of magnesium were more likely to have elevated CRP than adults who consumed less then RDA. One similar study

[21] done in Durango, a city in northern Mexico, divided the subjects into three groups on the basis of serum magnesium level 1) Subjects with normomagnesemia (>1.8mg/dl), 2) Subjects with hypomagnesemia (1.2-1.8mg/dl) 3) Subjects with severe hypomagnesemia (mg<1.2mg/dl) and found that no significant differences of hsCRP between the hypomagnesemic and normomagnesemic subjects but the subjects with severe hypomagnesemia (mg<1.2mg/dl) had higher serum levels of hsCRP. Mean value of serum magnesium in the study was 1.8mg/dl ( $\pm$  0.4).

Comparing with the above mentioned study, in this study mean value of serum magnesium was 2.01mg/dl ( $\pm$ 0.29) with range between 1.4mg/dl to 2.9mg/dl. There was no single value of serum magnesium below 1.2 mg/dl (no single case of severe hypomagnesemia) as well as mean value of serum magnesium was higher than the previous study.

Because of the limited number of study participants with very high or low serum magnesium, it is impossible to draw conclusion about the risk associated with serum magnesium that is far outside the normal range. However, the lack of such individuals in this sample, study does not reflect the characteristics of the general population.

By this result we cannot exclude the possibility that serum magnesium levels may be linked to C-reactive protein in other populations like individuals with chronic diseases or those with a higher prevalence of magnesium deficiency.

## 5. Conclusion

In contrast to the previous studies that linked higher serum magnesium to lower concentrations of biomarkers of systemic inflammation, the results of this study provide no evidence to support the hypothesis of a causal relationship between serum magnesium levels and C-reactive protein.

## Acknowledgement

Authors gratefully acknowledge all the volunteers in the study. Authors are thankful to all the members of department of Physiology and Biochemistry, King George's Medical University, Lucknow, India, for their support in the study.

## Conflict of interest

Authors declare no conflict of interest. Funding has been done by authors.

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