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Original Research Article

Co-relation of circulating magnesium with atherogenic dyslipidemia in north Indian adult population

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Abstract

Background: Role of magnesium in dyslipidemia is still controversial till date. Decreased serum magnesium levels are co-related with dyslipidemia. The aim of this study was to investigate the relationship between serum magnesium levels with components of lipid profile in apparently healthy adults.
Material and methods: This is a population based cross-sectional study. Total 130 apparently healthy adults of age between 25-65 years, were recruited with prior ethical approval and with written informed consent.
Results: Serum magnesium was found to be negatively correlated with triglyceride, VLDL and total cholesterol. Co-relation with TG($r = -0.23$, $p= 0.02$) and VLDL ($r = -0.28$, $p= 0.004$) was significant. However positive & mild correlation of serum magnesium with HDL and LDL was found.
Conclusion: As per the findings we concluded that serum magnesium was found to have significant negative correlation with serum TG and VLDL.
Keywords: Circulating magnesium, Atherogenic dyslipidemia, North Indian population

1. Introduction

Magnesium is second most abundant (after potassium) intracellular cation and is fourth most abundant cation of human body. Approximately half of the magnesium is found in the bones and half in the soft tissue. Less than 1% of the total body magnesium is found in the blood [1]. Magnesium exists in the serum in the three states; about one third of serum magnesium is bound to proteins, 25% with the albumin and 8% with the globulin [2]. In remaining two third of serum magnesium, 92% is free and 8% is complexed with phosphate, citrate and other compounds. Hypomagnesaemia was defined as serum magnesium concentrations ≤ 1.8 mg/dL (≤0.74 mmol/L) [3]. Major dietary sources of magnesium include whole grains, legumes, nuts, and green leafy vegetables.

Magnesium stabilizes the structure of adenosine triphosphate (ATP) in enzymatic reactions dependent on ATP and acts as a cofactor for more than 300 enzymes involved in metabolism of food components and synthesis of many metabolic products. It is essential for all living cells and acts as a cofactor for the synthesis of ATP, deoxyribonucleic acid (DNA), ribonucleic acid (RNA) and numerous metabolic enzymes and plays a role in intracellular signaling [4].

Total serum cholesterol level and its sub fractions, particularly low-density lipoprotein (LDL) cholesterol, have significant association with the risk for atherogenesis leading to coronary heart disease and peripheral arterial atherothrombotic disease [5]. It is found that a significant inverse correlation of serum magnesium with serum cholesterol and low-density lipoprotein cholesterol (LDL-C) but no association with serum HDL and triglyceride level [6]. It was also found that serum magnesium had significantly positive correlation with HDL-C, while total cholesterol and LDL-C was negatively correlated, albeit non-significantly, with serum magnesium [7]. Another study done on 45 known diabetic patients, observed significant negative relation of serum magnesium with triglyceride and very low density lipoprotein (VLDL-C) level and positive relation of magnesium with serum high-density lipoprotein cholesterol

(HDL-C) too [8]. Inconsistent results have been found regarding the role of magnesium in the relationship of different components of lipid profile. This study was designed to find out correlation between fasting serum magnesium and lipid profile 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 apparently healthy adults irrespective of sex with age between 25 and 65 years. We enrolled 130 apparently healthy adults for this study. 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 participants. This study was conducted under the principles of the Declaration of Helsinki.

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, chronic disorders of joint and connective tissue, psychosomatic disorder neurological disorders, history of intake of lipid lowering drugs, diuretics, cisplatin or any other medication which affect carbohydrate or lipid metabolism were excluded from the 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 fasting lipid profile and serum magnesium level.

2.2.1 Determination of lipid profile:

The VITROS CHOL slide method was used separately for estimation of total cholesterol, triglyceride and high-density lipoprotein (HDL). This is a colormetric method Microslide technology on Vitros 250 fully auto analyzer. The very low density lipoprotein (VLDL) and low density lipoprotein (LDL) was calculated by Friedwald equation:-

VLDL=TG/5

LDL= TC-VLDL- dHDL

2.2.2 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 ± 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.

3. Results

Distribution of all the biochemical parameters with mean and standard deviation are given in the Table-1. Co-relation of serum magnesium with different components of lipid profile is given in Table-2. Serum magnesium was found to have significant negative co-relation with triglyceride (r = -0.23, p=0.02*) and VLDL (r = -0.28, p=0.004*). Negative co-relation with total cholesterol was insignificant (r = -0.04, p=0.66). Serum magnesium was found to have insignificant positive co-relation with high-density lipoprotein HDL (r = 0.01, p=0.96) and LDL(r = 0.16, p=0.12).

Table-1: Distribution of biochemical parameters

Biochemical parameters	Mean ± SD	Minimum	Maximum
Total Cholesterol (mg/dl)	164.92±34.97	93	266
Triglyceride (mg/dl)	155.47±75.13	56	502
HDL (mg/dl)	42.55±10.17	22	71
LDL (mg/dl)	90.63±28.36	35	162
VLDL (mg/dl)	32.64±20.15	11	158
Serum Mg (mg/dl)	2.01±0.29	1.4	2.9

Table-2: Correlation of serum magnesium with parameters of lipid profile of the subjects

Lipid profile	Serum magnesium	
	Correlation coefficient (r^1)	p-value
Cholesterol	-0.04	0.66
TG	-0.23	0.02*
HDL	0.01	0.96
LDL	0.16	0.12
VLDL	-0.28	0.004*

[1]Spearman correlation *Significant (p<0.05)

4. Discussion

In this study serum magnesium is found to have significant negative correlation with TG (r -0.23, p= 0.02*), VLDL cholesterol (r -0.28, p=0.004*). Correlation with rest of the parameters was insignificant.

The possible mechanism by which magnesium affects lipid metabolism may be as follows. Magnesium is believed to be a cofactor for lipoprotein lipase [6]. Lipoprotein lipase (LPL) is the major enzyme responsible for hydrolysis of triglyceride (TG) molecules present in circulating lipoproteins

Several studies have found that magnesium supplementation is found to reduce TG, LDL cholesterol, VLDL and total cholesterol simultaneously increases HDL cholesterol level, which is a beneficial lipoprotein [9,10]. Besides supplementing magnesium, correlation of lipid levels were also found with serum magnesium level [11,8]. Hypomagnesemia elevated TC/HDL ratio [12]. Ionized magnesium was also found to be significantly reduced in

patients with low HDL cholesterol, high triglycerides [13]. It was also later shown in one of the study that serum magnesium was significantly inversely correlated with serum cholesterol and low-density lipoprotein cholesterol (LDL-C) but not correlated with serum HDL and TG level [6]. Another study found significantly positive correlation of magnesium with HDL-Cholesterol but not with any other fraction of lipid profile [7]. Results of these studies were in consistent with our study.

There was a study in which serum magnesium levels shown to have a negative correlation with HDL cholesterol but a positive correlation with triglyceride when general population was studied [14]. There are so many other studies which have shown conflicting results. When a study was performed in Type 1 DM patients of age 10–18 years, showed no correlation of serum magnesium with any of the lipid [15]. Similar results were obtained when a study was done in overweight, non-diabetic, normomagnesemic subjects [16] and in subjects between 19 and 62 years old, healthy without serious metabolic, cardiovascular or endocrine diseases [17]. One of the studies was done in adult Mexican population and showed a positive correlation between serum magnesium and HDL cholesterol levels only in patients with DM or impaired fasting glucose but not in normoglycemic individuals [18]. These all studies were in contrast to our study.

5. Conclusion

In summary, the present study was done in apparently healthy adults from the general population for correlation between serum magnesium and lipid profile. Serum magnesium was found to have significant negative correlation with serum TG and VLDL. Co-relation with rest of the components was not significant.

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Conflict of interest:

Authors declare no Conflict of interest.

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