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To study association of serum magnesium levels with lipid profile in newly diagnosed cases of Type II Diabetes Mellitus in Sub-Himalayan region

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Abstract
Background: *Diabetes mellitus is a common endocrinal disorder that is associated with the electrolyte imbalance in the body. Among them the magnesium levels have been found to be corelated with the HbA1C levels. Moreover, magnesium deficiency is associated with lipid metabolism in diabetic patients. Not much studies have been done on correlation between hypomagnesemia and lipid profile in sub-Himalayan region.*
Objectives: *To study association of serum magnesium levels with lipid profile in newly diagnosed cases of Type II Diabetes Mellitus*
Methods: *An analytical cross-sectional study was conducted among those newly diagnosed cases of type II diabetes mellitus, who gave consent for the study. The necessary blood investigations were performed and appropriate statistical tests were applied for analysis.*
Results: *The mean age of the patients was 51.32±10.4 years. A significant positive correlation of serum magnesium was found with serum cholesterol (r= 0.35, p=0.01) and serum high-density lipoproteins (r=0.35, p=0.02). No correlation was found between serum magnesium levels and the age of the newly diagnosed patients of type II diabetes mellitus.*
Conclusion: *The significant findings of the study concluded the positive correlation of serum magnesium levels with high density lipoproteins and total cholesterol, but this correlation is weak. More elaborate prospective studies are needed to further study on this aspect.*
Keywords-*Type II Diabetes Mellitus, HbA1C, Serum Magnesium, Lipid profile.*

Introduction

Diabetes is the most common endocrinal disorder seen in clinical practise. India has already become the 'Diabetic Capital' of the world. The rising number of people of type II diabetes mellitus is expected to be more than 300 million people globally by 2025[1]. Type II diabetes mellitus and lipid abnormality go hand in hand. Findings typically are elevated total cholesterol, VLDL, TG concentration and lower HDL-c and predominance of small dense LDL particles[2].

Remnant's of TG rich lipoproteins seem to be atherogenic[3]. The pro-atherogenic properties of small dense LDL particles may relate to their ability to penetrate the arterial wall, thereby, making them more susceptible to oxidation, and thus indirectly linked with coronary artery disease[4] [5]. Diabetes

mellitus is also associated with disturbance in electrolyte metabolism i.e. sodium and magnesium decrease while potassium increases. Among electrolytes magnesium significantly corelates with level of HbA1C and thus may be related to long term effects of diabetes[6].

Magnesium plays an important role in carbohydrate metabolism. It may influence the release and activity of insulin[7]. Low blood levels of magnesium are frequently seen in individuals with type II diabetes mellitus. Hypomagnesemia may worsen the insulin resistance[6]. There has been a link between the hypomagnesemia and reduction of tyrosine kinase activity at insulin receptor level, that may result in impairment of insulin action of development of insulin resistance.

Hypomagnesemia can increase platelet activity, vascular and adrenal response to angiotensin II, enhance thromboxane A2 release and lead to organ damage from free radicals. Magnesium deficiency has also role in perturbation of lipid metabolism, especially of diabetic patients[8].

A number of studies have reported beneficial effects of magnesium supplementation on plasma cholesterol and LDL, cholesterol, and on increase of HDL cholesterol[9] [10] [11].

Aims and Objectives
To study association of serum magnesium levels with lipid profile in newly diagnosed cases of Diabetes Mellitus in Sub-Himalayan region.

Materials and Methods
A descriptive analytical cross-sectional study was conducted for one year through September 2017-September 2018, among the newly diagnosed type 2 diabetes mellitus patients, at a tertiary care centre of Sub-Himalayan region. The patients diagnosed as Type II Diabetes mellitus for the first time, in the medicine OPD or those who were admitted in the medicine ward, were taken consecutively, for the study purpose after obtaining an informed consent.

Inclusion Criteria
1. Newly diagnosed type 2 diabetes mellitus Patients

2. Who consent to participate in the study

Exclusion Criteria
1. Patients on drugs that affect magnesium levels (diuretics, aminoglycosides, amphotericin B, etc)
2. Malabsorption or diarrhoea
3. Alcohol consumption
4. Vitamin or mineral supplements in recent past
5. Pregnancy & Lactation
6. Sepsis
7. Use of lipid lowering medications

The detailed history and clinical evaluation of the patients who fulfilled the inclusion was done.

Blood sample of the patients for fasting blood sugar, post-prandial blood sugar and HbA1C was sent for biochemical investigation to the SRL laboratory of the hospital. Serum magnesium levels, lipid profile consisting of Triglycerides, cholesterol, High-density lipoprotein and low-density lipoprotein were measured using standard methods if the laboratory of the institution. Other relevant investigations were also done in all newly diagnosed type II diabetes mellitus patients.

Data was analysed using Epi info version 7.2.1.0 software. Descriptive statistics were used to summarize the demographic data. Proportions and percentages were used to describe categorical variables. For continuous variables, mean and standard distribution were calculated. The data was analysed using appropriate statistical test techniques. Statistical significance was determined at p value of <0.05.

Results
The present study included 53 patients of newly diagnosed type 2 diabetes mellitus, that included 27 (50.9%) females and 26 (49.1%) males. The mean age of the patients was 51.32 ± 10.4 years. The mean serum cholesterol and LDL were 180.21 ± 50.83 and 117.34 ± 43.19 respectively. The baseline characteristics of these patients has been summarised in table 1.

Table 1: Baseline characteristics (including the laboratory tests (N=53)

Variables	Minimum	Maximum	Mean ± SD
Age (years)	32	78	51.32±10.4
BMI (kg/m^2)	20.31	33.74	24.88±3.08
FBS (mg/dl)	124	497	218.9±84.3
PPBS (mg/dl)	203	518	313.2±85.4
HbA1C %	6.6	17.5	10.0±2.7
Cholesterol (mg/dl)	22	296	180.21±50.83
TG's (mg/dl)	36	549	167.83±80.61
LDL (mg/dl)	42	262	117.34±43.19
HDL (mg/dl)	23	70	41.68±9.47
Magnesium (mg/dl)	1.2	3.0	1.95±0.28

In our study, significant positive correlation of serum magnesium was found with serum cholesterol (r= 0.35, p=0.01) and serum high-density lipoproteins (r=0.35, p=0.02). (Figure 1 and 2).

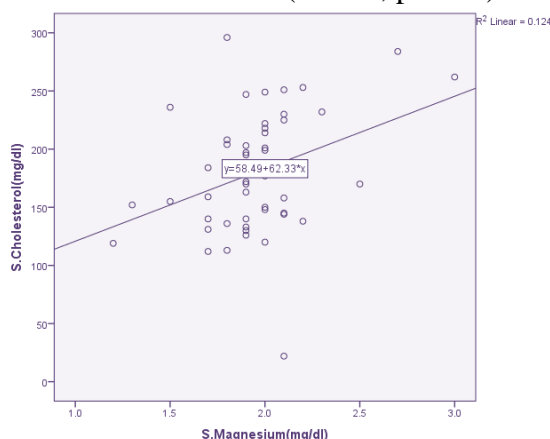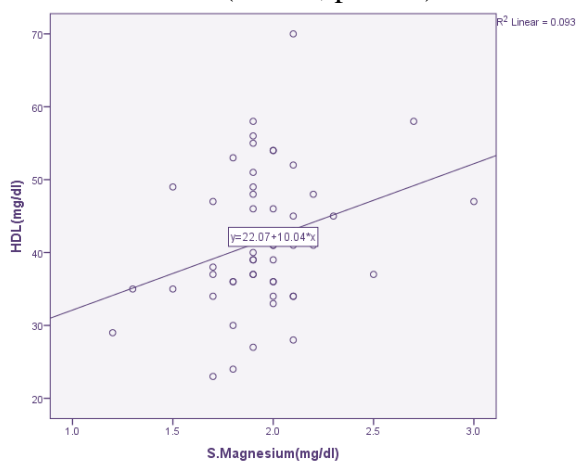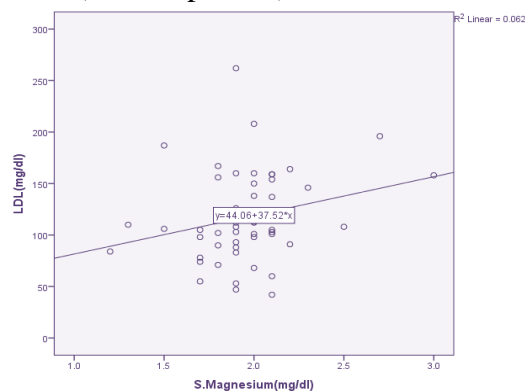**Figure 1:** Significant positive correlation of serum Mg with serum cholesterol.(r=0.35, p=0.01)

**Figure 2:** Significant Positive correlation of serum Mg with serum HDL (r=0.35, p=0.02)

However, a positive correlation was established between serum magnesium and low-density lipoprotein (r= 0.25, p=0.72), but it was not found to be statistically significant. (Figure 3)

Figure 3: Positive correlation of serum Mg with serum LDL (r=0.25, p=0.72)


A insignificant positive correlation was found between serum magnesium and triglycerides level (r=0.18, p=0.18). (Figure 4)

Figure 4: Positive correlation of serum Mg with serum Triglycerides. (r=0.18, p=0.18)
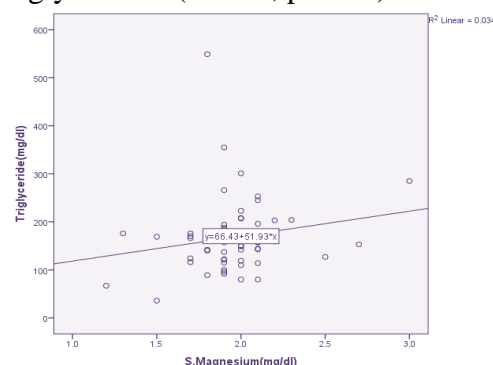
No correlation was found between serum magnesium levels and the age of the newly diagnosed patients of type II diabetes mellitus. (Figure 5)

Figure 5: Correlation of serum Mg with ages of the patients (r=0.05, p=0.97)
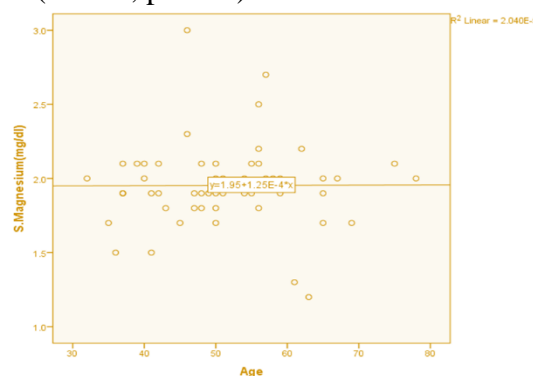
Discussion

In the present study on newly diagnosed patients of diabetes mellitus, the serum cholesterol, low density lipoproteins, high density lipoproteins, very low-density lipoproteins and high-density lipoproteins were found to be on the higher side. Dyslipidaemia in patients of diabetes mellitus is a common finding and is associated with the higher risk of atherosclerosis.

In our study of fifty-three patients of newly diagnosed Type II Diabetes Mellitus, the mean age of the participants was found out to be 51.32±10.4 years. The mean values of serum cholesterol and LDL were 180.21±50.83 and 117.34±43.19 respectively. However, in a study conducted by Hamid et al,[12] the mean patients age was 63±10 years, and mean levels of serum cholesterol and LDL were found to be 198±52 and 112±37 respectively.

The present study found that only 26.4% presented with hypomagnesemia. Schimatschek HF et al[13] in a study conducted in Germany found prevalence of magnesium deficiency to be 14.5%.

On analysing the serum magnesium levels with high density lipoproteins, a significant positive correlation (r=0.35, p=0.02) was found between them. This corroborated with the study by Sendhav SS et al,[14] where significant correlation of magnesium with serum HDL(r=0.26) in diabetic patients.

Further, positive correlation of serum magnesium was found with serum cholesterol (r= 0.35) and serum low-density lipoproteins(r=0.25). However, this correlation was significant only between serum magnesium and serum cholesterol levels (p=0.01). This was in contrast to the study by Hamid et al,[12] where significant inverse correlation of serum magnesium with cholesterol (r=-0.20, p=0.023) and also with serum LDL (r=-0.20, p=0.024) were found. The variation of certain results in our study could be attributed to the fact that the adjustment of other variables like age, creatinine clearance etc. were not done, that could have led to confounding in our study. Also, the dietary pattern in sub-Himalayan regions vary from other areas, that lead to these results.

No significant correlation was found between serum magnesium levels and the age of the type II diabetes mellitus patients. This was again different from the study by Hamid et al,[12] where inverse correlation was observed between the serum magnesium levels and age of the patients.

Conclusion

The significant findings of the study concluded the positive correlation of serum magnesium levels with high density lipoproteins and total cholesterol, but this correlation is weak. Being a time-bound study, the sample size of the newly diagnosed type II diabetic patients is not sufficient enough to make conclusions on correlation.

Since, scarce evidence-based studies to establish the biological plausibility of correlation of serum magnesium levels with the lipid profile of diabetic patients have been done till now, so elaborate large-scale prospective studies are needed to substantiate such linear relationships.

References

1. Ramachandran, A.; Das, AK. Diabetology. In: Shah Siddharth N, Paul AM, editors. API textbook of medicine. 7th ed. Mumbai: The Association of Physicians of India; 2003. Pp. 1097-1098.

2. American Diabetes Association. Standards of medical care in diabetes. Diabetes Care 2007 Jan;30(Suppl 1):S4-S41.

3. Car J, Patel H, Srishanmuganathan J, Majeed A. Diabetes care in developing countries. Can Med Assoc J 2004 Jan;176(2): 209-212.

4. Goldfine AB, Beckman J A. Life and death in Denmark: lesson about diabetes and coronary heart disease. Circulation 2008 Apr;117: 1914-1917.

5. Kuussisto J, Mykkanen L, Pyorala K, Laakso M. NIDDM and its metabolic control predict coronary heart disease in

elderly subjects. Diabetes 1944 Aug;43(8): 960-967.

6. Institute of Medicine. Food and Nutrition Board. Dietary reference intakes: Calcium, phosphorus, magnesium, vitamin D and fluoride. National Academy Press. Washington DC, 1999.

7. Kobrin SM and Goldfarb S. Magnesium deficiency. Semin Nephrol 1990; 10: 525-35

8. The significant findings of the study concluded the positive correlation of serum magnesium levels with high density lipoproteins and total cholesterol, but this correlation is weak.

9. Yokota K, Kato M, Lister F, et al. Clinical efficacy of magnesium supplementation in patients with type 2 diabetes. J am Coll Nutr. 2004 Oct; 23(5): 506S-9S.

10. Rasmussen HS, Aurup P, Goldstein K, et al. Inflence of magnesium substitution therapy on blood lipid composition in patients with ischemic heart disease A double-blind, placebo-controlled study. Arch Intern Med. 1989 May; 149 (5); 1050-1053

11. Hagg E, Carlberg BC, Hillron VS, Villumsen J. Magnesium therapy in type 1 diabetes. A double bling study concerning effects on kidney function and serum lipid levels. Magnes Res 1999; 12: 123-130.

12. Hamid Nasri. Lipid in Association with serum magnesium in diabetes mellitus patients. Bratisl Lek Listy 2008; 109 (7); 302-306

13. Schimatschek HF, Rempis R. Prevalence of hypomagnesemia in an unselected German population of 16,000 individuals. Magnes Res 2001;14:283- 90.

14. Sendhav SS, Kakaiya A, Chatterjee B. Evalution of serum magnesium level along with lipid profile in a Gujarati population diagnosed with diabetes mellitus. Indian J Med Biochem 2017;21(2): 112-16.