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Biochemical Variations of Serum Magnesium with Lipid Analytes in Different Clinical Groups of Type 1 and Type 2 Diabetes Mellitus- An Original Research

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ABSTRACT:
Background: The present study was undertaken for assessing biochemical Variations of Serum Magnesium with Lipid Analytes in Different Clinical Groups of Type 1 and Type 2 Diabetes Mellitus.
Materials & methods:100 subjects were enrolled in the present study. All these 100 subjects were cases of diabetes mellitus. Another set of 100 normoglycemic healthy subjects were taken as controls. Complete demographic and clinical details of all the subjects were enrolled. All the subjects of the study group were divided into two groups: T1DM (Type 1 diabetes mellitus) and T2DM (Type 2 diabetes mellitus). All the patients of the study group were further subcategorized into three sub-groups: Subgroup I, Subgroup II and Subgroup III. Subgroup II: Newly diagnosed cases of DM not under any treatment. Subgroup II: Stabilized DM under treatment. Subgroup III: Long course, uncontrolled DM associated with noted complications. Blood samples were obtained from all the patients and magnesium levels along with serum lipid analytes triacylglycerol (TAG) and total cholesterol were measured. All the results were recorded and analyzed by SPSS software.
Results: Significant results was obtained while comparing fasting plasma glucose levels, serum magnesium levels, serum total cholesterol level and serum triglycerides levels between healthy controls and subgroup I and in between healthy controls and subgroup III. Non-significant results were obtained while comparing the mean plasma glucose levels, serum magnesium levels, serum total cholesterol level and serum triglycerides levels among T1DM patients and T2DM patients among various subgroups.
Conclusion: Physicians should prescribe serum magnesium as a routine investigation of diabetes diagnostic profile for preventing long-standing critical diabetes complications.
Key words: Magnesium, Lipid, Diabetes Mellitus

INTRODUCTION

Diabetes mellitus and its complications have become important public health problems around the world, and the incidence of diabetes mellitus has reached the rate of epidemic. Diabetes is a chronic disease that requires continuous medical care to prevent acute complications and reduce chronic complications. Whether suffering from complications or the extent of illness varies from person to person. Although the clinical manifestations of diabetes complications are diverse, but there are some common pathophysiological characteristics exist in these syndromes, trace elements are one of the important factors. Magnesium (Mg) has a critical role in the actions of important enzymes and is the fourth most abundant cation in the human body. It is claimed that there is an inverse relationship between Mg intake and incidence of diabetes mellitus (DM). Mg deficiency is common in diabetic patients. The incidence of hypomagnesemia varies between 11 and 47.7%. Compared with the control group, incidence of hypomagnesemia in newly diagnosed diabetes is 10.5-fold and in patients with previously diagnosed diabetes is 8.5-fold more common.[1- 4]

Several vitamins a minerals act as a cofactors an enzyme reaction regulated by insulin deficiencies of certain vitamin and minerals such as vitamin E, potassium, magnesium zinc and chromium may aggravate carbohydrate intolerance out of all these, it is relatively easy to detect potassium or magnesium concentrations in serum and to replace them based on their low serum levels. Homeostasis of the trace elements such as zinc, copper, iron and magnesium (Mg) has been found to play an important role in the pathogenesis of diabetes and diabetic complications. Magnesium is an essential element and has a fundamental role in carbohydrate metabolism in general and in Insulin action in particular. Mg has received considerable attention for its potential in improving insulin sensitivity and preventing diabetes and its cardiovascular complications.[5- 7]Hence; the present study was undertaken for assessing biochemical Variations of Serum Magnesium with Lipid Analytes in Different Clinical Groups of Type 1 and Type 2 Diabetes Mellitus.

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MATERIALS & METHODS

The present study was undertaken for assessing biochemical Variations of Serum Magnesium with Lipid Analytes in Different Clinical Groups of Type 1 and Type 2 Diabetes Mellitus. 100 subjects were enrolled in the present study. All these 100 subjects were cases of diabetes mellitus. Another set of 100 normoglycemic healthy subjects were taken as controls. Complete demographic and clinical details of all the subjects were enrolled. All the subjects of the study group were divided into two groups: T1DM (Type 1 diabetes mellitus) and T2DM (Type 2 diabetes mellitus). All the patients of the study group were further subcategorized into three sub-groups: Subgroup I, Subgroup II and Subgroup III. Subgroup II: Newly diagnosed cases of DM not under any treatment. Subgroup II: Stabilized DM under treatment. Subgroup III: Long course, uncontrolled DM associated with noted complications. Blood samples were obtained from all the patients and magnesium levels along with serum lipid analytes triacylglycerol (TAG) and total cholesterol were measured. All the results were recorded and analyzed by SPSS software.

RESULTS

Mean age of the patients of the healthy controls, subgroup I, subgroup II and subgroup III was 43.8 years, 41.3 years, 45.9 years and 46.2 years respectively. Mean serum magnesium levels among healthy controls, Subgroup I, Subgroup II and Subgroup III was 2.05 mmol/L, 1.48 mmol/L, 1.83 mmol/L and 1.21 mmol/L respectively. Mean serum total cholesterol levels among healthy controls, Subgroup I, Subgroup II and Subgroup III was 174.6 mg/dL, 235.9 mg/dL, 192.7 mg/dL and 293.4 mg/dL respectively. Mean serum triglycerides levels among healthy controls, Subgroup I, Subgroup II and Subgroup III was 82.4 mg/dL, 129.7 mg/dL, 96.6 mg/dL and 194.3 mg/dL respectively. Significant results was obtained while comparing fasting plasma glucose levels, serum magnesium levels, serum total cholesterol level and serum triglycerides levels between healthy controls and subgroup I and in between healthy controls and subgroup III. Non-significant results were obtained while comparing the mean plasma glucose levels, serum magnesium levels, serum total cholesterol level and serum triglycerides levels among T1DM patients and T2DM patients among various subgroups.

Table 1: Demographic profile

Variable	Healthy controls	Subgroup I	Subgroup II	Subgroup III
Mean age (years)	43.8	41.3	45.9	46.2
Males (n)	63	23	15	21
Females (n)	37	16	13	12
Total (n)	100	39	28	33

Table 2: Glycemic profile, magnesium levels and lipid profile among various subgroups

Variable	Healthy controls	Subgroup I	Subgroup II	Subgroup III
Fasting plasma glucose (mg/dL)	93.6	174.6	108.4	228.3
Serum magnesium (mmol/L)	2.05	1.48	1.83	1.21
Serum total cholesterol (mg/dL)	174.6	235.9	192.7	293.4
Serum triglycerides (mg/dL)	82.4	129.7	96.6	194.3

Table 3: Comparison of glycemic profile, magnesium levels and lipid profile among various subgroups

Variable	Healthy controls Vs Subgroup I	Healthy controls Vs Subgroup II	Healthy controls Vs Subgroup III
Fasting plasma glucose (mg/dL)	0.01*	0.824	0.01*
Serum magnesium (mmol/L)	0.00*	0.436	0.00*
Serum total cholesterol (mg/dL)	0.00*	0.350	0.00*
Serum triglycerides (mg/dL)	0.03*	0.195	0.01*

*: Significant

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DISCUSSION

Dyslipidemia a frequent feature of insulin resistance syndrome is another risk factor for pathogenesis in T2DM. Hypomagnesemia has a role in the perturbation of lipid metabolism in DM. It was demonstrated that subjects with hypertension have a marked increase in the prevalence of hypercholesterolemia, DM, hypomagnesemia, and hypertriglyceridemia. A literature search of previous epidemiological studies showed serum magnesium was associated and correlated with various biochemical analytes mostly in T2DM with a paucity of evidence in T1DM.[8- 10]The Fenofibrate Intervention and Event Lowering in Diabetes (FIELD) study, conducted in T2D patients in Australia, New Zealand, and Finland; showed that the incidence of coronary events during the 5-year period did not differ between the two groups receiving 200 mg/day of fenofibrate or placebo, but 24% of risk reduction of non-fatal myocardial infarction was shown in the fenofibrate group.[10] Hence; the present study was undertaken for assessing biochemical Variations of Serum Magnesium with Lipid Analytes in Different Clinical Groups of Type 1 and Type 2 Diabetes Mellitus.

In the present study, mean age of the patients of the healthy controls, subgroup I, subgroup II and subgroup III was 43.8 years, 41.3 years, 45.9 years and 46.2 years respectively. Mean serum magnesium levels among healthy controls, Subgroup I, Subgroup II and Subgroup III was 2.05 mmol/L, 1.48 mmol/L, 1.83 mmol/L and 1.21 mmol/L respectively. Mean serum total cholesterol levels among healthy controls, Subgroup I, Subgroup II and Subgroup III was 174.6 mg/dL, 235.9 mg/dL, 192.7 mg/dL and 293.4 mg/dL respectively. Arpaci D et al evaluated 673 diabetic patients. According to Mg levels, the patients were divided into two groups; as normomagnesemic patients and hypomagnesemic patients. Among the patients, 57.8% were men and 42.2% were women. Mean age was 55.6 years and the mean duration of diabetes was 81 ± 86.9 months. The mean glycosylated hemoglobin (HbA1c) was 9.0 ±2.4 % (4.5-18); mean magnesium level was 1.97 ± 0.25 (1.13 to 3.0) mg / dl. There were 55 patients (8.2%) with diabetic retinopathy and 95 patients (14.1%) with diabetic neuropathy. Five hundred patients (74.3%) hadnormoalbuminuria; 133 patients (19. 8%) had microalbuminuria (MA) and 40 patients (5.9%) had overt proteinuria. One hundred and seventy one patients (25.4%) had HbA1c levels equal or below 7%; and 502 patients (74.6%) had HbA1c levels above 7%. There was no statistical difference in age or duration of diabetes between the groups formed according to Mg levels. Although there were no differences between the groups for retinopathy and neuropathy, MA was more common in hypomagnesemic patients ($p = 0.004$). HbA1c levels did not differ between the groups ($p = 0.243$). However there was a weak negative correlation between serum Mg and HbA1c levels ($r = -0.110$, $p = 0.004$) and also between serum Mg and urine protein level ($r = -0.127$, $p = 0.018$). Mg depletion is a common problem in patients with DM. It affects both glycemic regulation and the occurrence of complications. Also, poor glycemic regulation affects serum Mg levels.[11]

In the present study, Mean serum triglycerides levels among healthy controls, Subgroup I, Subgroup II and Subgroup III was 82.4 mg/dL, 129.7 mg/dL, 96.6 mg/dL and 194.3 mg/dL respectively. Significant results was obtained while comparing fasting plasma glucose levels, serum magnesium levels, serum total cholesterol level and serum triglycerides levels between healthy controls and subgroup I and in between healthy controls and subgroup III. Non-significant results were obtained while comparing the mean plasma glucose levels, serum magnesium levels, serum total cholesterol level and serum triglycerides levels among T1DM patients and T2DM patients among various subgroups. Kumar P et al correlated serum magnesium with lipid analytes in different clinical groups of both T1DM and T2DM, and validate its diagnostic significance. The study comprised 250 subjects with random inclusion of 200 of both T1DM, T2DM, and 50 normoglycemic healthy controls. Based on medical history and clinical records of 52 T1DM and 148 T2DM clinical cases, they were subgrouped into group I—newly diagnosed, group II—stabilized controlled, and group III—with long course, uncontrolled with associated complications. Hypomagnesemia was inversely correlated with hypertriacylglycerolemia and hypercholesterolemia in hyperglycemic of both T1DM and T2DM with varied statistical significances in different clinical groups with ($p < 0.001$) in group III, ($p < 0.01$) in group I, and ($p > 0.05$) non-significant in group II. However, no statistical significance ($p > 0.05$) for analytes was noted between type 1 and type 2 of all subgroups.[12]

CONCLUSION

From the above results, the authors concluded physiciansshould prescribe serum magnesium as a routine investigation of diabetes diagnostic profile for preventing long-standing critical diabetes complications.

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