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ORIGINAL ARTICLE

COMPARATIVE STUDY OF SERUM LIPIDS AND MAGNESIUM LEVELS IN CONTROLLED & UNCONTROLLED TYPE 2 DIABETES MELLITUS CASES

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ABSTRACT: Diabetes mellitus refers to a group of common metabolic diseases that share the phenotype of hyperglycemia. The metabolic dysregulation associated with diabetes causes secondary pathogenic changes in multiple organ systems that impose a tremendous burden on the individual with diabetes and on health care system. Present study was undertaken to investigate serum lipids and serum magnesium levels in type 2 diabetes mellitus cases based on their glycated hemoglobin levels. The purpose of this study was thus to gather information about the relation between degree of control of diabetes and level of lipids and magnesium in serum. In the present study we observed a significant decrease in magnesium levels, increase in LDL cholesterol levels in diabetic patients with poor control.

KEYWORDS: Diabetes mellitus, Serum magnesium, LDL cholesterol, Glycated hemoglobin.

INTRODUCTION: With an increasing incidence worldwide diabetes mellitus will be a leading cause of morbidity and mortality for the foreseeable future.[1] chronic hyperglycemia can cause significant alterations in the status of some micronutrients and on the other hand some of these nutrients can directly modulate glucose homeostasis. So this study was done to evaluate relation between serum magnesium and lipids with the course of type 2 diabetes mellitus. Patients with type-2 diabetes have increased risk of cardiovascular disease associated with atherogenic dyslipidemia, especially cardiovascular disorder and cerebrovascular accident.[2] Hyperglycemia and atherosclerosis are related in type-2 diabetes.[3] Persistent hyperglycemia causes glycosylation of all proteins, especially collagen cross linking and matrix proteins of arterial wall. This eventually causes endothelial cell dysfunction, contributing further to atherosclerosis. The prevalence of dyslipidemia in diabetes mellitus is 95%.[4] The cardiovascular disease is a cause of morbidity and mortality in patients with diabetes mellitus because of disturbance in lipoproteins i.e. serum triglycerides (TG) 69%, serum cholesterol 56.6%, low-density lipoprotein cholesterol (LDL) 77% and high density lipoprotein cholesterol (HDL) 71%.[5,6] Myocardial infarction is the leading cause of morbidity and mortality worldwide.[7] 13.7% to 47.7% of type 2 diabetic mellitus cases were found to have hypomagnesemia.[8,9,10,11,12,13] In diabetes there is a direct relationship between serum magnesium level and cellular glucose disposal that is independent of insulin secretion. This change in glucose disposal has been shown to be related to increased sensitivity of the tissues to insulin in presence of adequate magnesium levels.[14] Hypomagnesaemia is also known to have atherogenic potency.[15] by promoting endothelial dysfunction, platelet aggregation and vascular calcifications, leading to future vascular complications.[16]

A definite understanding of relevant biochemical changes is thus necessary to correctly understand the pathophysiology and to identify biochemical markers that help in preventing complications in type 2 diabetes patients. In the present study we have studied the changes in the levels of magnesium and lipids in type 2 Diabetic patients in relation to their hbA1C levels.

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MATERIALS AND METHODS: The subjects included in the present study were 100 patients suffering from Diabetes mellitus. Glycated hemoglobin (HbA1C) of all patients was measured. 50 patients with controlled glycemic status (HbA1C <8.0) and another 50 subjects with uncontrolled glycemic status (HbA1C >8.0) were divided into 2 groups. All the subjects were known diabetics in the age group of 48+/-10 yrs. We have excluded cases with CRF, Acute MI, Chronic diarrhea & epilepsy. Persons on drugs like diuretics, magnesium supplements, and magnesium containing antacids were excluded. We also have excluded pregnant women with hypertension, proteinuria, & eclampsia.

This study was approved by an institutional review board and informed consent was obtained from all subjects involved in the study. Participants were in the supine position for 5 to 10 minutes before venipuncture and 5ml of fasting venous blood was collected. 4ml was collected in plain bottle and allowed to clot to separate serum. Another 1ml was taken in EDTA tube for HbA1C estimation. The following methodology was applied to the samples to obtain the required parameters. Serum was separated within one hour after sample collection. Care was taken to avoid hemolysis. Serum from all 100 subjects was analyzed for the following parameters:

1. Serum glucose by GOD-POD method.
2. HbA1C by Ion exchange resin method.
3. Serum cholesterol by CHOD-PAP method.
4. Serum triglycerides by GPO – Trinder method
5. HDL cholesterol by Phospho tungstic acid method.
6. Serum Magnesium by Calmagite method.

All the parameters were analyzed

Statistical analysis was done using SPSS software. Results were expressed as mean, +/- SD. Statistical correlation was done using partial correlation test and significance was expressed in the form of 'p' value. 'p' value of <0.5 was considered statistically significant and 'p' value <0.01 was considered highly significant.

RESULTS:

Parameter	Controlled DM Mean +/- SD	Uncontrolled DM Mean +/- SD	'p' Value
FBS	99.4+/- 14.10	144.86+/-29.35	<0.001
HbA1C	6.8+/-0.4	9.86+/-1.02	<0.001

Table1: Table showing Mean +/- SD & p values of fasting blood sugar & HbA1C in controlled & uncontrolled diabetes mellitus (DM)

Parameter	Controlled DM Mean +/- SD	Uncontrolled DM Mean +/- SD	'p' Value
Total cholesterol	171.66+/-16.70	202.93+/-51.00	<0.001
Triglycerides	239+/-33.67	240+/-101.79	<0.001
HDL cholesterol	44.13+/-8.16	34.46+/-5.98	<0.02
LDL cholesterol	99+/-18.58	119+/- 43.66	<0.001

Table 2: Table showing mean +/-SD & p values of total cholesterol, triglycerides, HDL-cholesterol & LDL-Cholesterol in controlled & uncontrolled diabetes mellitus (DM)

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Parameter	Controlled DM Mean +/- SD	Uncontrolled DM Mean +/- SD	'p' Value
Serum magnesium	2.25+/-0.15	1.85+/-0.24	<0.001

Table 3: Table showing Mean+/-SD & p values of serum magnesium levels in controlled & uncontrolled diabetes mellitus (DM)

From the above Tables 1, 2 & 3, fasting blood glucose levels, HbA1C levels, total cholesterol, triglycerides, LDL cholesterol were significantly raised in patients with uncontrolled type 2 diabetes mellitus compared to controlled diabetes mellitus cases. There is no significant change found in HDL cholesterol levels. Serum magnesium was found to be decreased significantly in patients with uncontrolled type 2 diabetes mellitus compared to controlled diabetes mellitus cases.

DISCUSSION: The prevalence of type 2 diabetes is rising much more rapidly, presumably because of increasing obesity, reduced activity levels as countries become more industrialized and the ageing population. As the prevalence of type 2 diabetes with complications is increased for the past decades, the present study was chosen to study the association of serum lipids and magnesium in these patients.[17] the metabolic dysregulation associated with diabetes mellitus causes secondary pathogenic changes in multiple organ systems that impose a tremendous burden on the individual with diabetes.

Insulin resistance and obesity combine to cause dyslipidemia and hyperglycemia which have additive cardiovascular risk. In diabetes mellitus carbohydrate utilization is impaired and lack of insulin sensitivity leads to uncontrolled breakdown of lipids and proteins. This in turn causes availability of more acetyl CoA which is responsible for hyperlipidemia.[18,19,20] Elevated free fatty acids in diabetes are consistently observed and are related to the degree of hyperglycemia. Altered metabolism of triglyceride rich lipoproteins is crucial in the pathophysiology of atherogenic dyslipidemia of diabetes. Levels of LDL cholesterol are predictive of coronary artery disease. Lowering LDL cholesterol is important in decreasing cardiovascular disease morbidity and mortality.[21,22,23]

Magnesium is involved in multiple levels in insulin secretion, binding & activity. Mg activates more than 300 enzymes in body and is a critical cofactor of many enzymes in carbohydrate metabolism. Cellular magnesium deficiency alters the activity of sodium potassium ATPase pump.[24] which is useful in maintenance of sodium, potassium and glucose transport. Magnesium depletion is thus said to have effect on homeostasis of blood glucose and insulin sensitivity in type 2 diabetic patients as well as on the development and progression of complications. Early diagnosis & prompt treatment of complications of diabetes mellitus can improve the quality of life and increases life expectancy.

This work was carried out to study the correlation between glycosylated hemoglobin, magnesium status, & serum lipids in diabetic patients. Cases with poorly controlled glycemic status depicted deranged lipid levels and mg levels when compared to controlled glycemic status cases. The main reason for poor glycemic control in type 2 diabetes may be lack of education about its control and future developing cardiovascular and cerebro vascular complications.

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CONCLUSION: Outcome study showed that majority of type 2 diabetes mellitus cases with uncontrolled blood sugar levels and HbA1C levels had their lipid levels and magnesium levels deranged. Glycemic control seems to be of paramount management of diabetes induced lipid and magnesium abnormalities. All efforts to ensure good glycemic control should be made by necessary dietary modification (calorie control, supplementation with monounsaturated fats etc.) and the use of pharmacological agents for lowering triglycerides and cholesterol, for improving serum magnesium levels.

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